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Hydrology Report

Lake Mountain and Middle Tompkins Grazing Allotment Management Plan Project

Oak Knoll and Scott River Ranger Districts, Klamath National Forest, Siskiyou County, CA

T44N, R11W, Sections 3-10, 16-18; T44N, R12W Sections 1,12,13; T45N, R11W, Sections 2-5, 8-11, 14-18, 19-23, 26-34; T45N, R12W, Section 25, 36; T46N, R11W Sections 17, 20, 21, 26-29, 32-36, Mt. Diablo Meridian

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Executive Summary

The Oak Knoll and Scott River Ranger Districts on the Klamath National Forest are proposing to authorize grazing permits for 10 years under an Adaptive Management Strategy (AMS) and update the Allotment Management Plan (AMP) for Lake Mountain and Middle Tompkins allotments. The project includes redevelopment of Lookout Spring in the Lake Mountain Allotment with construction of a half-acre exclosure around the springhead and seep and an exclosure fence around the headcut at Faulkstein Meadow. Both these areas are susceptible to livestock impacts. Topography of both allotments is steep; some slopes are estimated to exceed 50%, especially at the upper limits of watersheds and at lower elevations where drainages enter Scott River. Gentler slopes are mostly restricted to ridgetops, spur-ridges, and concave landscapes formed around stream headwaters interspersed with small dry, wet, and moist meadows where most grazing occurs. The focus of this report is to compare the existing conditions of Lower Scott River and middle Klamath River to the desired conditions along with describing the effects of the no-action and action alternatives on shade, sedimentation, stream temperature, Riparian vegetation condition, peak and base flow, channel geomorphology, and nutrients. This report also takes in account of the effects of the Happy Camp Complex wildfire during the summer of 2014.

Methodology

The effects of the Proposed Action, no action and action alternatives were analyzed through field visits, GIS reports and modeling. Field visits focused on meadows and streams adjacent to meadows in high and moderate use areas because remaining portions of the allotments are mostly inaccessible to livestock as a result of steep terrain and dense vegetation. In addition to inaccessibility, these forested stream channels are typically resilient to disturbance due to their boulder and cobble streambank composition. Stream banks in meadow areas within the allotments tend to have finer-textured soils and are more susceptible to disturbance and impacts associated with livestock grazing, however, they are primarily located in areas with low gradients with low stream flows.

Analysis Indicators

Impacts to beneficial uses for watersheds and riparian areas within the project area will be determined using the following analysis indicators.

- Sediment delivery to streams (estimated by sediment monitoring data)
- Changes in peak flow/base flow (estimated by ERA)
- Changes to temperature (estimated by stream shade and temperature monitoring data)
- Riparian vegetation condition (specialists visual inspection)
- Channel condition/geomorphology (estimated by potential change in conditions)
- Nutrient input (specialists visual inspection and peer reviewed journal article)

Spatial and Temporal Context

The watershed spatial scale is bound by the 7th-field (HUC14) and 5th-field (HUC10) from the watershed boundary dataset (WBD). The temporal scale is described as being either short- or long-term in duration. Short-term (direct and indirect) is usually from 1 to 3 years; but can be up

to 10 years. Long-term (indirect) is any effect persisting for more than 10 years. Effects are put into context by using the following spatial scales: (1) Site-effects located in stream channels adjacent to or nearby the treatment area and that do not extend downstream; (2) Reach-effects that can extend downstream for less than 100 meters; and (3) Watershed-effects that can be measured in the response reach of a 7th -field watershed.

Connected Actions, Past, Present and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

See Chapter 3 of the EA.

Affected Environment

The Lake Mountain and Middle Tompkins allotments have 2 main drainages. Watersheds in the Lake Mountain Allotment drain into the middle Klamath River upstream from Seiad Valley and those in the Middle Tompkins Allotment drain into Scott River. The Scott River is listed in the 303(d) Clean Water Act for stream temperature and sediment impairment (California State Water Quality Control Board (CSWQCB, 2010a). As a result of 303(d) listing, the Klamath River Stream Temperature Total Daily Maximum Load (TMDL) was developed to reduce and prevent excess sediment inputs and maintain and restore site potential stream shade in an effort to decrease water temperatures. Excessive sediment loads and elevated water temperatures in the Scott River and its tributaries have resulted in degraded water quality conditions that impair designated beneficial uses, including contact (REC-1) and non-contact water recreation (REC-2); commercial and sport fishing (COMM); cold freshwater habitat (COLD); rare, threatened, and endangered species (RARE); migration of aquatic organisms (MIGR); and spawning, reproduction, and/or early development of fish (SPWN) (CSWQCB 2010b). The middle Klamath River is also 303(d) listed under the Clean Water Act for temperature, dissolved oxygen, nutrients, organic enrichment, and sediment. A Klamath Action Plan was developed to address these issues. To help implement the Klamath River TMDL, the waiver of waste discharge requirements for non-point sources on federal lands includes conditions to actively treat legacy sediment sources and maintain and improve stream shade North Coast Regional Water Quality Control Board (NCRWQCB, 2010). For the Middle Klamath River, the designated beneficial uses that are not fully supported include: cold freshwater habitat (COLD); rare, threatened, and endangered species (RARE); migration of aquatic organisms (MIGR); spawning, reproduction, and/or early development of fish (SPWN); commercial and sport fishing (COMM); Native American cultural use (CUL); subsistence fishing (FISH); and contact and non-contact water recreation (REC-1 and REC-2). Both the TMDL and Waste Discharge Requirement require a stream sediment and temperature monitoring program to help determine existing conditions, develop reference conditions and track recovery.

Little is known concerning riparian and stream channel characteristics and aquatic habitat conditions prior to the onset of activities such as mining, road building, and timber harvesting that began during the mid-1850s. It is presumed the habitat was in good condition to support the salmon and steelhead populations reported by miners and by R.D. Hume in Snyder's (1931) report. The extent of damage that mining and other human activities had on the physical characteristics of the streams, including pools, fine sediments, riparian vegetation, and stream

channels, is unknown, however, it was probably extensive. During 1934, streams were lower than they had been during the previous decade and hydraulic mining was still occurring in areas of the Klamath Basin.

Riparian areas affected by the Happy Camp Complex wildfires will continue to recover, especially in Tompkins Creek-Scott River, Macks Creek, Mitchell Creek, O'Neil Creek, and Mill Creek as trees become established and grow. The primary watershed responses of the Happy Camp Complex wildfire area expected to include: 1) an initial flush of ash, 2) rill and gully erosion in drainages and on steep slopes within the burned area, and 3) flash floods with increase peak flows and sediment deposition. These responses are expected to be greatest within initial storm events. The disturbances will become less evident as vegetation is reestablished, providing ground cover and increasing surface roughness. Soils will also become stabilized and the infiltration capacity of the soils will improve (Bousfield and Kwan, 2014).

Lands affected by the 1997 flood will also continue recovering throughout the assessment area; riparian vegetation will slowly increase and shade will improve. In stream channels not severely affected by the flood or fires, the proportion of dense, late-seral vegetation in riparian areas will increase as trees grow larger and older. Some dense, early-seral stands may stagnate as tree densities approach site capacity. Areas with poor site quality will probably change little over time. Overall instream aquatic habitat should slowly improve over time as impacts of the fire and flood continue to diminish. Pool habitat will increase in heavily scoured streams over the next decade. Riparian area conditions will continue to fluctuate with future intense storm events and wildfires (USFS, 2000a).

The project includes redevelopment of Lookout Spring in the Lake Mountain Allotment, with construction of a half-acre exclosure around the springhead and seep. In addition, a water trough will be installed for livestock. Installation of the fence and trough will stop the trampling at this specific site and improve water quality. Additionally, the project will include fencing a vulnerable area within the Faulkstein meadow where a headcut has formed. The installation of the fence will prevent the livestock from exacerbating the headcut.

Between 2009 and 2012 Klamath National Forest measured streambed sediment in low gradient stream channels located near the mouth of 79 watersheds. Reference conditions were developed from 20 reference streams for V*, percent fine sediment on the riffle-surface, and percent fine sediment in the streambed subsurface. Tompkins Creek within the Middle Tompkins Allotment was measured for V*. Stream sediment monitoring on the KNF from 2011 found Tompkins Creek (managed stream) demonstrated a sediment indicator that met reference conditions. However, it suggests that some beneficial uses may be impaired because recorded subsurface sediment size of <6.38mm and <0.85mm were both over reference condition (USFS, 2013).

Stream temperature monitoring on the KNF from 2010 and 2011 found two watersheds within Middle Tompkins Allotment, Tompkins Creek and Middle Creek, exceeded maximum weekly water temperature during 2010 at 17.5^{0}C for Tompkins Creek and 17.3^{0}C for Middle Creek. During 2011, Tompkins Creek exceeded maximum weekly water temperature at 16.5^{0}C. Stream temperatures warmer than 16^{0}C are considered over the threshold in beneficial uses for core juvenile salmonids (USFS, 2012).

Stream shade was estimated for perennial streams on Klamath National Forest using the Shade-a-lator model with inputs for vegetation derived from remote sensing data. Air photo interpretation was used to verify the remote sensing data, and to identify reaches where stream shade has been reduced by human activities. The amount of shade loss resulting from human activities was estimated by comparing the modeled shade in altered reaches with nearby stream reaches that

lack human disturbance. A total of 44 out of 87 watersheds on the Forest have human-caused shade loss. Two Creeks within the Middle Tompkins Allotment were measured in 2011 showed an existing percentage of shade in the Tompkins Creek at 90.3% and Middle Creek at 90.5% (USFS, 2011).

During the summer of 2011, two grazing allotments, Mill Creek and Shackleford, were enrolled in a water quality study by UC Davis Rangeland Watershed Laboratory Department to determine if microbial and nutrient pollution by livestock on public lands degrades water quality such that it threatens human and ecological health. They found that nutrient concentrations throughout the grazing season were at least one order of magnitude below ecological levels of concern. The results were similar to U.S. Environmental Protection Agency's estimates for background water quality conditions for the region (Roche et al., 2013).

Sample sites were selected spatially to allow analysis relative to possible pollution sources in key livestock grazing areas, campgrounds, and recreational areas (swimming holes). In the Mill Creek Allotment, nutrients were found below levels of ecological concern. Average and median fecal indicator bacteria concentrations were below regulatory standards, however, 10% of samples exceeded the REC-1 fecal coliform standard, 6% exceeded the REC-2 fecal coliform standard and 6% exceeded the EPA *E. coli* standards (Tate, 2011a). In the Shackleford Allotment, nutrients were well below levels of ecological concern, with the exception of a single sample that had elevated total phosphorous. Average and median fecal indicator bacteria concentrations were well below regulatory standards, however, 8% of samples exceeded the REC-1 fecal coliform standard, 2% exceeded the REC-2 fecal coliform standard and 1% exceeded the EPA *E. coli* standards (Tate, 2011b).

Environmental Consequences

Alternative 1-No Action

Direct Effects and Indirect Effects

Under this alternative, grazing activities would cease and the risk of having grazing-related influences on riparian areas and water quality would be eliminated. The stream courses within the Lake Mountain and Middle Tompkins Allotments would remain untouched by livestock activities. On a watershed wide basis, there would be no changes to water quality or quantity if grazing activities were to cease that is detectable at the watershed scale. While grazing activities have the potential to deliver sediment to water courses, effects are localized. Therefore, there are no direct or indirect effects to water quality on a watershed scale. On a site or reach scale, there will be a direct positive effect. Sediment and shade should improve without livestock browsing and trampling within the Riparian Reserve.

Cumulative Effects

All insignificant beneficial effects are restricted to Lake Mountain Allotment because only this allotment would undergo management change to discontinue grazing. Cumulative effects would be beneficial on a site and reach scale but not detectable on a watershed scale. Middle Tompkins Allotment has not been grazed since 2007, therefore, removal of livestock would not alter the existing condition. Although there are direct positive effects to water quality, based upon the CWE data from Appendix B, the cumulative effects will not be detectable at the watershed scale.

Therefore, there are no cumulative effects within the Lake Mountain or Middle Tompkins Allotment.

Alternative 2- Proposed Action

Direct Effects and Indirect Effects

The project includes redevelopment of Lookout Spring in the Lake Mountain Allotment, with construction of a half-acre exclosure around the springhead and seep for water quality protection. In addition, a water trough will be installed for livestock. Direct effect of livestock within the Riparian Reserve is livestock trampling and excrement along streams or within streams, meadows, or wet areas where there's a direct route into a stream introducing nutrients and fine sediment. Indirect effects are degraded water quality such as adding fecal coliforms into the stream and potentially exceeding water quality standards. Streambank trampling can add sediment into the stream altering channel morphology. This in turn, can increase stream temperature by widening the stream, allowing additional solar exposure. Livestock browsing can also affect the Riparian Reserve by removing vegetation crucial to bank stability and removing shade that is critical to keeping the stream cool. Additionally, a livestock fence will be installed at Faulkstein meadow to protect a headcut in the meadow. Direct effect of the proposed action would be the protection of the headcut and preventing livestock trampling in a vulnerable site.

Most of the high use and moderate use areas within both allotments were visited and analyzed for water quality impacts. Since Middle Tompkins Allotment has been rested for 7 years, no significant negative impacts of grazing were found. In the Lake Mountain Allotment, livestock as well as wildlife excrement were found within the Riparian Reserve of streams and within meadows, however, water quality studies on two active allotments on the KNF in 2011 resulted in nutrients below levels of ecological concern (Tate 2011a; Tate 2011b).

Cumulative Effects

A future foreseeable action for which there is the potential for cumulative impact is the Westside Fire Recovery 2015 Project. Proposed actions potentially overlap with Lake Mountain and Middle Tompkins Allotment Management Plan. The primary interaction between effects from Westside Fire Recovery2015 Project and Lake Mountain and Middle Tompkins Allotment Management Plan is the opportunity for livestock to move to areas of the allotments not utilized in the past by following new forage prospects. Salvage harvest for Westside Fire Recovery is preliminary, but is generally mid- to upper-slope and avoids most Riparian Reserves, however, hazardous trees treatment and hazardous fuels treatment could occur in Riparian Reserves. The most likely consequence for interaction between the two projects is for livestock to spread out upon the landscape, taking advantage of temporary forage opportunities, with livestock returning to patterns similar to pre-fire as temporary forage opportunities decrease.
There is some uncertainty of how livestock will respond to proposed treatments from the Westside Fire Recovery 2015 Project and the cumulative effect to water quality. Water quality (sediment, peakflow, water temperature, Riparian Reserve vegetation, channel condition, and nutrients) is not expected to change due to the Westside Fire Recovery 2015 Project, however, water quality is expected to change due to the Happy Camp Complex Wildfire. Specifically, peakflow and sediment are expected to increase due to the wildfire.

Alternative 3- Current Management

Direct Effects and Indirect Effects

The effects of Alternative 3 are similar to Alternative 2 except for fewer disturbances to the Riparian Reserve since Alternative 3 includes grazing within the Lake Mountain Allotment and no grazing within the Middle Tompkins Allotment. Allotment boundaries would remain unchanged and the exclosure and trough would not be installed at lookout spring. Furthermore, the proposed fence around Faulkstein meadow headcut would not be installed.

Cumulative Effects

Alternative 3 would continue current management practices upon the Lake Mountain Allotment. Because current management is similar to Alternative 2 in respect to water quality impacts, the cumulative effects discussion presented is also valid. In summary, there is some uncertainty of how livestock will respond to proposed treatments. Water quality (sediment, peakflow, water temperature, Riparian Reserve vegetation, channel condition, and nutrients) is not expected to change due to the Westside Fire Recovery 2015 Project, however, water quality is expected to change due to the Happy Camp Complex Wildfire. Specifically, peakflow and sediment are expected to increase due to the wildfire.

Compliance with law, regulation, policy, and the Forest Plan

The conditions in the Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Federal Land Management Activities on National Forest System Lands in the North Coast Region are met for this project as detailed in the Water Quality resource report. Meeting the Waiver requirements equals compliance with the Clean Water Act. Forest Plan standards are met by consistency with the Aquatic Conservation Strategy, as displayed in Appendix A and the Forest Plan Consistency Checklist, available on the project website.

Hydrology Report

Introduction

The project area encompasses approximately 24,868 acres and straddles the Oak Knoll and Scott River District boundary of the Klamath National Forest west of Scott Bar, California in Siskiyou County. The legal locations are T44N, R11W, Sections 3-10, 16-18; T44N, R12W Sections 1,12,13; T45N, R11W, Sections 2-5, 8-11, 14-18, 19-23, 26-34; T45N, R12W, Section 25, 36; T46N, R11W Sections 17, 20, 21, 26-29, 32-36, Mt. Diablo Meridian. Private land accounts for about 473 acres within the project boundary, leaving about 24,395 acres that may be authorized for grazing on National Forest System lands.
Topography is steep; some slopes are estimated to exceed 50%, especially at the upper limits of watersheds, and at lower elevations where drainages enter Scott River. Gentler slopes are mostly restricted to ridgetops, spur-ridges, and concave landscapes formed around stream headwaters. Elevations range from approximately 1500 feet near the Klamath River to 7000 feet at the Lake Mountain and Tom Martin Peaks.

Table 1. Watershed (5th field HUC) and drainages (7th field HUC) in the project area

HUC 10	5th field HUC (watershed)	HUC 14	7th field HUC (drainage)
1801020610	Horse Creek – Klamath River	18010206110301	Tom Martin Creek-Klamath River
		18010206110304	Schutts Gulch-Klamath River
1801020806	Lower Scott River	18010208060501	Deep Creek-Scott River
1801020611	Seiad Creek-Klamath River	18010206110303	O'Neil Creek
		18010208060403	Tompkins Creek
		18010208060401	Middle Creek
		18010206110101	Upper Grider Creek
		18010206110103	Rancheria Creek
		18010208060601	McCarthy Creek-Scott River

Grazing lands within the Lake Mountain Allotments are located within the headwaters of Kuntz Creek, Mill Creek, Mitchell Creek, and Mack's Creek. Grazing lands within the Middle Tompkins Allotment are located within the headwaters of Tompkins Creek, Middle Creek, Rancheria Creek, and Fish Creek. Lake Mountain Allotment streams drains into the Klamath River near Seiad and Middle Tompkins Allotment streams drains into the Scott River. The majority of the allotments are characterized by mixed confer vegetation on a steeply dissected

landscape, much of which is inaccessible to livestock because of slope steepness or dense understory brush. The headwaters of these watersheds are on gentler terrain and are interspersed with small, dry, wet, and moist meadows where most grazing occurs (**Figure 1**).

Grazing in the allotments is strongly tied to riparian areas because of presence of water and green forage. The available grazing meadows are located at high elevations typically over 5000 feet, with a short growing season. Portions of the rangelands within the allotments are vulnerable to cattle impacts, particularly in riparian areas where rock and cobble stream banks are limited and bank stability is largely attributable to alders, willows and grasses.

Faulkstein Meadow is located within the Middle Tompkins Allotment and is more susceptible to livestock disturbance than other meadows within the allotment due to past disturbances. Fish Creek is a spring-fed perennial channel that flows into Faulkstein Meadow. Field reconnaissance and evaluation by the ID Team determined that the creek was disturbed by an old skid trail that most likely occurred between 37-46 years ago when most acres were harvested within the watershed (USFS, 1999). Fish creek is currently flowing down this skid trail. The evaluation also revealed that the creek has had some restoration efforts for stabilization. Specifically, rock and wood structures were put into the creek for bank stabilization and sediment retention and are restoring the creek from the past disturbance. The wooden structures were scorched during the Happy Camp Complex wildfire and currently function, however they will not be long-lasting. Falling trees will serve as a replacement for these structures in the future. Fish Creek originates from the top of the ridge, then flows down a conifer-dominated riparian stand with excellent shade, and then flattens out in a meadow before continuing downhill into another conifer-dominated riparian stand. There's quite a gradient change from the meadow to downstream of the meadow. Restoration efforts in the past mitigated the gradient change by the installation of a rock apron; however, the flow dynamics have changed and the stream is currently piping through the meadow and causing a headcut to form. Until equilibrium is reached and the gradient change returns to stable channel conditions, the headcut will continue to move uphill.

Riparian condition and water quality and quantity are closely linked and influenced by grazing activities. Grazing activities can have both direct and indirect impacts to riparian areas and water quality and water quantity. Direct impacts to riparian areas from grazing include destabilization of stream banks and compaction of soils in wet areas such as in springs, wetlands, and floodplains. Two BMP evaluations have been completed on the Lake Mountain Allotment at the Lookout Spring area; one in 2012, and a follow-up evaluation in 2013. Monitoring results from 2012 indicated that hoof prints affect more than 10% of this small spring area and may be impacting soil saturation; however the herbaceous vegetation appeared to be in excellent vigor and was mostly composed of mid to late seral species. Implementation standards and guidelines were met, however, fencing the spring area and piping water into a trough outside the exclosure was recommended. Indirect grazing impacts to riparian areas include sediment delivery, channel widening, and decrease summer flows. Another direct impact to water quality from grazing is the introduction of sediment and fecal matter. Fecal matter influences both drinking water quality and nutrient levels which in turn can have an indirect effect by influencing dissolved oxygen levels. Elevated water temperatures can also be an indirect effect associated with grazing through excessive grazing of riparian vegetation with subsequent shade reduction, and through channel widening from collapse of destabilized channel banks that result in more solar exposure to stream channels. Changes to water quantity are both an indirect and a cumulative effect and are associated with altered peak storm flows and summer low flows.

A significant body of literature documents the extent to which livestock grazing has the potential to significantly influence riparian areas and water quality. Scientific literature documents that livestock can negatively influence water quality by destabilizing channel banks with trampling which can in turn negatively influence channel morphology (USDI, 2006). Bank trampling can result in channel bank erosion, sedimentation, channel widening and loss of pools, all of which can have negative impacts on aquatic habitat and ecosystem health.
In addition, livestock can negatively influence riparian health through overgrazing of riparian vegetation. Excessive grazing of riparian species can potentially impact habitat quality by reducing bank cover and stability as well as by converting deep-rooted riparian species to more shallow-rooted species as with conversion of willow shrubs to grasses and forbs (Clary and Webster, 1989).

Methodology

The effects of the Proposed Action, no action and action alternatives were analyzed through field visits, GIS reports and modeling. Field visits were focused on meadows and streams adjacent to meadows in high and moderate use areas since the remaining portions of the allotments are mostly inaccessible to livestock due to the steepness of terrain and dense vegetation. In addition to inaccessibility, these forested stream channels are typically resilient to disturbance due to their boulder, cobble stream bank composition. Stream banks in meadow areas within the allotments tend to have finer-textured soils and are much more susceptible to disturbance and impacts associated with livestock grazing, however, they are mostly in areas with low gradient and low flows since they tend to be high up in the watershed around springs.
Most of the high use and moderate use areas within both allotments were visited and analyzed for water quality impacts through sampling the most sensitive and intensively grazed areas. An estimate was made of the sedimentation associated with grazing activities (i.e. cow crossings, trampling within the Riparian Reserve) deliverable to streams in the Lake Mountain Allotment. Since Middle Tompkins Allotment has been rested for 7 years, no significant negative impacts of grazing were found, and herbaceous vegetation including grasses and forbs was at or near high vigor, however, woody vegetation including willows was generally uncommon within meadows and shade was minimal. It is not known why there is a lack of woody vegetation within the Middle Tompkins Allotment meadows. Livestock use of woody vegetation may constitute only a portion of total use when native ungulates are considered (George et al., 2011). This was true in Middle Tompkins Allotment meadows that had been rested for 7 years. In streams adjacent to meadows, shade was generally abundant and canopy cover was over 80% in both allotments.
The Cumulative Watershed Effects analysis models project site specific actions within the context of 7th-field watersheds (drainages, from 3,000 to 10,000 acres in size). Seventh field watersheds are aggregated to characterize 6th- and 5th-field watersheds. The CWE models analyzed the risk associated with direct and indirect effects of the existing road system and past and present actions in combination with the Proposed Action and the action alternatives, as well as future foreseeable actions. Appendix B contains complete CWE results and methodology.

Analysis Indicators

The following indicators are used to determine the effects to beneficial uses of water from the project.

- Sediment Delivery to Streams

    - This indicator is analyzed using the estimated sediment delivery from the Cumulative Watershed Effects (CWE) model ERA (Equivalent Roaded Acres) which estimates changes to disturbance along with V* which measures streambed sediment.
- Changes in Peak Flow
    - This indicator is analyzed using the CWE Equivalent Roaded Acres (ERA) model. It estimates the level of hydrologic disturbance or relative risk of increased peak flows and the consequent potential for channel alteration and adverse watershed impacts.
- Changes to Temperature
    - This indicator uses change to shade to estimate the effects of the alternative on perennial and late-flowing intermittent stream temperature.
- Riparian Vegetation Condition
    - This indicator is analyzed qualitatively based on the overall functionality of the Riparian Reserves (RR). It also incorporates riparian vegetation and any impacts from browsing along with plant vigor and diversity.
- Channel Condition/Geomorphology
    - This indicator is analyzed qualitatively based on expected impacts to the channel during implementation and the increase in debris flow potential as a result of each alternative. Existing coarse woody debris (CWD) and trees available for recruitment as CWD are considered. It also incorporates streambank trampling and crossings.
- Nutrients
    - This indicator is analyzed based upon the water quality study on two allotments within the Klamath National Forest.

Temporal and Spatial Boundaries

Effects can be beneficial, neutral (effects are outside the range of statistical confidence), negative (measurable effects that do not retard beneficial uses) or adverse (measurable effects that retard beneficial uses). Direct effects are those occurring at the same time and place as the action. Direct effects are usually short-term, lasting for a few years. Indirect effects are those occurring at a later time or distance from the action and can be short-term or long-term. The temporal scale is described as being either short- or long-term in duration. Short-term (direct and indirect) is usually 1 to 3 years, but can be up to 10 years. Long-term (indirect) is any effect that persists for more than 10 years. Negative effects are put into context by using the following spatial scales: (1) Site-effects located in stream channel adjacent to or nearby the treatment area and that do not extend downstream; (2) Reach-effects that can extend downstream for less than 100 meters; and (3) Watershed-effects can be measured in the response reach of a 7th-field watershed. Surface sediment erosion recovers quickly (several years) due to soil cover from needle cast and fallen branches covering disturbed sites. Sediment delivery due to mass-wasting is long-term and can last for several decades before hill slope hydrology is restored. Altered stream flows can be short- or long-term, depending on elevation and forest type. Cumulative effects are short- and long-term since they combine all past, present and proposed direct and indirect effects.

The cumulative watershed effects analysis models project site specific actions within the context of 7th field watersheds (drainages, from 3,000 to 10,000 acres in size). Seventh field watersheds

are aggregated to characterize 6th and 5thfield watersheds. For Lake Mountain, there are four 7th-field watersheds (O'Neil Creek, Schutts Gulch-Klamath River, Tom Martin Creek-Klamath River, Tompkins Creek). For Middle Tompkins, there are seven 7th-field watersheds (Deep Creek-Scott River, McCarthy Creek-Scott River, Middle Creek, Rancheria Creek, Tom Martin Creek-Klamath River, Tompkins Creek, and Upper Grider Creek).

Affected Environment

The existing conditions within the project area were analyzed through a combination of office and field reviews. Existing data such as the Lower Scott Ecosystem Analysis and the Thompson/Seiad/Grider Ecosystem Analyses were reviewed in the office. Cumulative watershed effects models were also used to characterize the existing conditions. Field reviews of stream course Riparian Reserve function, channel characteristics and sediment source identification confirmed the office assessments. This section has been organized into the most relevant aspects of water resource management and protection; beneficial uses, watershed condition, channel condition, riparian condition, and water quality and quantity.

The intent of the Clean Water Act is met on National Forest System land by complying with water quality standards developed by the State of California, as authorized by the U.S. Environmental Protection Agency pursuant to the Federal Clean Water Act of 1972. The Porter-Cologne Act, California's corresponding state law, assigns responsibility for protection of water quality within North Coast watersheds to the North Coast Regional Water Quality Control Board (NCRWQCB). The NCRWQCB implements and enforces the Porter-Cologne Act, and the Water Quality Control Plan for the North Coast Basin (Basin Plan). Water quality objectives are outlined in the Basin Plan. The primary purpose for maintaining water quality is to assure that the beneficial uses of water are not adversely affected. When water quality objectives are met, and beneficial uses protected, then the State considers that a project meets water quality standards.

The Forest Service entered into a Management Agency Agreement (1981) with the NCRWQCB and State of California requiring the Forest Service to institute a water quality management program to meet applicable water quality objectives and protect beneficial uses. Under the agreement, implementation of State-approved and Environmental Protection Agency (EPA)-certified best management practices (BMPs) are considered sufficient to protect water quality from non-point sources of pollution (USFS, 2000b). Compliance with the Clean Water Act and the water quality objectives of the Basin Plan are achieved by meeting the conditions of the *Waiver of Waste Discharge Requirements for Nonpoint Source Discharges Related to Certain Land Management Activities on National Forest System Lands* (NCRWQCB Order No. R1-2010-0029; 2010 Waiver). Compliance with the conditions of the waiver also constitutes compliance with the sediment, temperature, dissolved oxygen, and nutrient requirements of the Klamath TMDL.

Beneficial Uses

The Klamath River is designated as a Recreational component of the National Wild and Scenic River system, with approximately 35 miles of the river flowing through the analysis area. Grider Creek was found suitable and recommended for inclusion in the Wild and Scenic Rivers System. State Highway 96, which parallels the Klamath River through the analysis area, is part of the State of Jefferson National Scenic Byway. The analysis area provides for human uses and values

as diverse as the biological features; and habitats found within them. The diversity of forest habitats near the Klamath River provided ideal conditions for prehistoric settlement along the river. The Karuk and Shasta Indian Tribes are the first known inhabitants who lived in the lower elevations adjacent to the Klamath River. Karuk descendants living in the region continue to value and use traditional resources consistent with their cultural heritage. Europeans arrived in 1850 as miners entered the Klamath River region in search of gold. For approximately 50 years, mining activity was the most important rural industry. The numerous streamcourses provide water for domestic and agricultural use. There are range allotments in the Seiad Creek watershed, and in the Marble Mountain Wilderness (USFS, 1999).

The main stem of lower Scott River in the analysis area is a funnel for all anadromous fish activity (escapement, out-migration, rearing) in the Scott River system. Water quality and water flow issues are critical. Tributaries, such as Canyon, Kelsey, Middle, Tompkins, and Mill Creek, provide the only consistent perennial connection with the Scott River. Major upstream tributaries, such as Shackleford, Kidder, and, at times, even portions of the main stem of Scott River, go intermittent during summer months. Due to low flow conditions and elevated water temperatures, it is felt that many of the fish, as a result of spawning activity in the upper valley, flee to the canyon area to rear. Access into several analysis area tributaries is also possible for rearing purposes. As a result, the Lower Scott Analysis Area is viewed as vital to sustaining existing anadromous processes within the entire sub-basin (USFS, 2000a).

The Basin Plan (NCRWQCB, 2011) lists the beneficial uses for the Scott Bar Hydrologic Subarea and the Seiad Valley Hydrologic Subarea for the Middle Klamath River Hydrologic Area for "**Existing**" or "**Potential**" beneficial uses (see Appendix C).

Scott River and its tributaries have resulted in degraded water quality conditions that impair designated beneficial uses, including contact (REC-1) and non-contact water recreation (REC-2); commercial and sport fishing (COMM); cold freshwater habitat (COLD); rare, threatened, and endangered species (RARE); migration of aquatic organisms (MIGR); and spawning, reproduction, and/or early development of fish (SPWN) (CSWQCB 2010b). Water originating from the Scott Valley is often of poor quality in summer because of agricultural water diversions, pollution from agricultural runoff (animal wastes, fertilizers, pesticides, herbicides), impoundment behind dams, and industrial discharge. This sometimes results in increased water temperature, depletion of dissolved oxygen, increases in toxic substances (such as ammonia and phosphorus), and other factors that can make the river environment intolerable for salmon, steelhead, and other species. Pure cool water from tributaries is important, and may be critical, in maintaining water quality in the Klamath River and providing thermal refugia for fish (USFS, 2000).

For the Middle Klamath River, designated beneficial uses not fully supported include: cold freshwater habitat (COLD); rare, threatened, and endangered species (RARE); migration of aquatic organisms (MIGR); spawning, reproduction, and/or early development of fish (SPWN); commercial and sport fishing (COMM); Native American cultural use (CUL); subsistence fishing (FISH); and contact and non-contact water recreation (REC-1 and REC-2). Water originating from the upper Klamath Basin and the Shasta and Scott Valleys is often of poor quality during summer because of agricultural water diversions, pollution from agricultural runoff (animal wastes, fertilizers, pesticides, and herbicides), impoundment behind dams, and industrial discharge. These intervening factors sometimes contribute to increased water temperature, depletion of dissolved oxygen, increases in toxic substances (including ammonia and phosphorus), and other factors which can make the river environment intolerable for salmon,

steelhead, and other species. Pure cool water from Thompson/Seiad/Grider subwatersheds is important, and may be critical, in maintaining water quality in the Klamath River and providing thermal refugia for fish (USFS, 1999). Beneficial uses are expected to change due to the Happy Camp Complex wildfire.

Channel Condition

The 7th field watersheds within the allotments (Tom Martin Creek-Klamath River, Schutts Gulch-Klamath River, Deep Creek-Scott River, O'Neil Creek, Tompkins Creek, Middle Creek, Upper Grider Creek, Rancheria Creek, and McCarthy Creek-Scott River) are characterized by well-confined, steep gradient, high-energy lower order-streams (Rosgen A-type channels) to small streams with moderate sinuosity and gentle gradients in meadows (Rosgen E5-type channels). There's generally a high bedload sediment transport that often occurs with a step-pool, cascading channel that is often influenced by large woody debris, soil conditions, and past disturbances (Rosgen, 1996).

Proper Functioning Condition (PFC) evaluations were completed during 2013 on Kuntz Creek headwaters within the Lake Mountain Allotment and on Townsend Meadow, Tyler Meadow, and Faulkstein Meadow within the Middle Tompkins Allotment. All were in Proper Functioning Condition except for the lower section in Faulkstein Meadow. There is a large headcut that has formed at the lower section in Faulkstein Meadow, unrelated to cattle. This section of Faulkstein meadow was rated as nonfunctional. Other than the lower section in Faulkstein Meadow, all sites were in good conditions with minimal livestock crossings (<1% at Kuntz Creek). Riparian vegetation consists of grasses and forbes within the meadows with some alder, willow, and cedar adjacent to creeks. Riparian vegetation is well established and stream banks are stable. Channel conditions are expected to change due to the Happy Camp Complex wildfire. Initial erosion of ash and surface soil during the first storm events will reduce slope roughness by filling depressions above rocks, logs, and remaining vegetation. The ability of the burned slopes to detain water and sediment will be reduced accordingly. This will aid in the potential for flashy floods and will increase the distance that eroded materials are transported (Bosfield and Kwan, 2014)

Temperature

Water quality standards for stream temperature are specified in the Water Quality Control Plan for the North Coast Region, referred to as the Basin Plan (NCRWQCB, 2011). Compliance with the temperature objective requires an assessment of whether the natural water temperature has been altered. Steam shade is used as a surrogate for water temperature as described in the load allocations for the Klamath River TMDL (NCRWQCB, 2010b). In streams where the natural shade has been altered, compliance can still be demonstrated if the existing stream temperatures are cold enough to support beneficial uses. Support of beneficial uses can be assessed by comparing measured stream temperatures to the TMDL thresholds for adverse effects. Watersheds with altered shade must also demonstrate that temperatures have not increased by more than 5^0F (2.8^0C). Stream temperature was monitored during the summer low flow period at a network of 87 watersheds representing most of the major tributaries on the Klamath National Forest. Reference conditions were monitored in 20 minimally disturbed watersheds that represent the natural background condition.

Stream temperature monitoring on the KNF from 2010 and 2011 found two watersheds within Middle Tompkins Allotment, Tompkins watershed and Middle Creek watershed, exceeded maximum weekly water temperature in 2010 at 17.5^{0}C for Tompkins watershed and 17.3^{0}C. In 2011, Tompkins watershed exceeded maximum weekly water temperature at 16.5^{0}C. Stream temperatures warmer than 16^{0}C are considered over the threshold in beneficial uses for core juvenile salmonids (USFS, 2012). Steam temperature is expected to change due to the Happy Camp Complex wildfire, especially within the moderate and high severity burn areas due to the lack of shade.

Riparian Vegetation Condition

For the analysis area, Hydrologic Riparian Reserves include the area within 100 meters (approximately twice the site potential tree height) of fish-bearing streams, and within 50 meters (approximately site potential tree height) of other streams, ponds, and wetlands (see Geology report for Geologic Riparian Reserves). Acres of Hydrologic Riparian Reserves by allotment are shown in Table 2 along with acres by use level. Numbers in parentheses indicate percentage of total riparian reserves by use category. As shown in Table 2, <1% of Hydrologic Riparian Reserve areas correspond with High Use Levels. Moderate use is from <1% to <3%. Capable areas range from 21% -23% and not used is from 75-77%. Riparian Reserve conditions were evaluated at all sites visited in 2012 and 2013 within the Lake Mountain and Middle Tompkins Allotments. Most Riparian Reserves were in good condition. Streambank trampling was most obvious within meadows. Within each meadow visited; the entire spring and stream network was traversed and evaluated. Streambank trampling was minimal within meadows at <10%. Streams adjacent to meadows were evaluated and streambank trampling was also minimal, approximately 1% of which caused by livestock crossings. Riparian Reserve vegetation was at high vigor along streams with excellent shade. Shade measurements ranged from 80-90%. Riparian Reserve vegetation in meadows was at high vigor; however, shade was minimal because of lack of woody species like willow and alder. Shade was mostly provided by overhanging vegetation with measurements ranging from 20-30%. Shade measurements were similar between the Lake Mountain (grazed) and Middle Tompkins (ungrazed) Allotments. Livestock trampling and foraging within the Hydrologic Riparian Reserve can degrade stream banks, alter stream flows, deplete riparian vegetation, and add sediment into stream channels. Grazing is allowed in Riparian Reserves and Forest Plan Standard and Guideline MA10-73 guides range managers to "adjust grazing practices to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives (ACS)" (Page 4-144). In most cases these High and Moderate Use areas are small segments and the Riparian Reserves as a whole supports attainment of ACS objectives. Due to the Happy Camp Complex Wildfire, Riparian Reserve vegetation has changed, especially within the moderate and high fire intensity areas, however, the existence of fine roots in the low and moderate severity burn areas just below the surface will likely aid plant recovery, and suggests there still might be a seed source for natural vegetation recovery. The major concern for vegetative recovery and in turn hydrologic recovery is in the high severity burn areas (Bosfield and Kwan, 2014).

Riparian vegetation varied greatly because of the large area of the allotments. Generally, riparian vegetation consisted of Red Alder, Douglas Fir, Ponderosa Pine, Canyon Live Oak, Big Tooth Maple, Mountain Alder, and various willow species.

A total of 446 miles of altered channel were identified by air photo inventory within the air photo study area. In addition roughly 90 miles of the Klamath, Scott, and Salmon Rivers were altered within the photo area. Channel alterations were most severe in Walker and Deep Creeks, where major debris flows traversed the entire channel length. In these streams, the floodplain was significantly altered and most of the riparian vegetation removed. The alluvial fan at the mouth of Walker Creek was built up considerably. Effects were less pronounced at Tompkins, Grider, Kelsey, and Indian Creeks. See **Figure 1** with attached watershed names. In these streams, debris slides in steep headwaters generated debris flows in some tributaries, but most of the main stems appear to have experienced only hyperconcentrated flood flows, and most riparian vegetation survived there. Nevertheless, these creeks lost local patches of riparian vegetation, much of the floodplain was disturbed by deposition or scour, and large accumulations of woody debris were deposited. In some areas, logs were trapped by stands alders 20-30 years old. Based on observations of fisheries personnel, there appeared to be considerable reduction in size, volume, and depth of pools in Elk, Indian, Beaver, Grider, Tompkins, South Fork Salmon, and Walker Creeks, and there is a larger proportion of fine sediment in the substrate (De Le Fuente and Elder, 1998). Riparian Vegetation has changed dramatically due to the Happy Camp Complex wildfire in those watersheds affected by the wildfire, specifically; Tom Martin Creek-Klamath River had the highest burn severity as compared to the other watersheds within the two allotments (**Figure 2**). Within the high severity burn, shown in red in Figure 2, all vegetation are dead or dying. The negative impacts will continue until vegetation is reestablished.

Table 2. Acres of Riparian Reserve by Allotment and Use Level (numbers in parentheses indicate percent of Hydrologic Riparian Reserves

Use Level (Acres)	Lake Mountain	Riparian Reserve Acres in Analysis area (%)	Middle Tompkins	Riparian Reserve Acres in Analysis area (%)	Lake Mountain proposed	Riparian Reserve Acres in Analysis area (%)	Middle Tompkins Proposed	Riparian Reserve Acres in analysis area (%)
Capable	2340	541(22)	2920	867 (22)	1490	257(21)	3830	1007 (23)
Moderate Use	175	34(1)	55	22 (<1)	175	34(<3)	121	55 (1)
High Use	12	0	17	1 (<1)	12	0	30	6 (<1)
Not Used	5141	1924(77)	11808	3003 (77)	3653	930(76)	12809	3282 (75)
Total Acres	**9590**	**2499**	**14800**	**3893**	**5330**	**1221**	**16790**	**4350**

*Acreages may contain rounding errors.

Sediment

Between 2009 and 2012 the Klamath National Forest measured streambed sediment in low gradient stream channels located near the mouth of 79 watersheds. Reference conditions were developed from 20 reference streams for V*, percent fine sediment on the riffle-surface, and percent fine sediment in the streambed subsurface. Tompkins Creek (managed stream) in the Middle Tompkins Allotment was measured for V*. Stream sediment monitoring on the KNF from 2011 found Tompkins Creek had sediment indicator meeting reference conditions (**Table 3**). However, it suggests that some beneficial uses may be impaired because the subsurface sediment size <6.38mm and <0.85mm are both over reference condition (USFS, 2013). Sediment is expected to increase in affected watersheds due to the Happy Camp Complex wildfire, specifically in O'Neil Creek and Tompkins Creek 6th field watersheds. Initial erosion of ash and surface soil during the first storm events will reduce slope roughness by filling depressions above rocks, logs, and remaining vegetation. The ability of the burned slopes to detain water and sediment will be reduced accordingly. This will aid in the potential for flashy floods and will increase the distance that eroded materials are transported (Bosfield and Kwan, 2014). A significant storm event will mobilize this sediment and send it downstream to perennial channels such as Tompkins, Walker, and Grider Creek where water quality could become a problem.
As provided in the report, *"[t]he 85th percentile was selected to represent conditions that fully support beneficial uses based on the judgment of the North Coast Regional Water Quality Control Board."*

Table 3. Sediment values for Tompkins Creek and the 85th percentile reference conditions

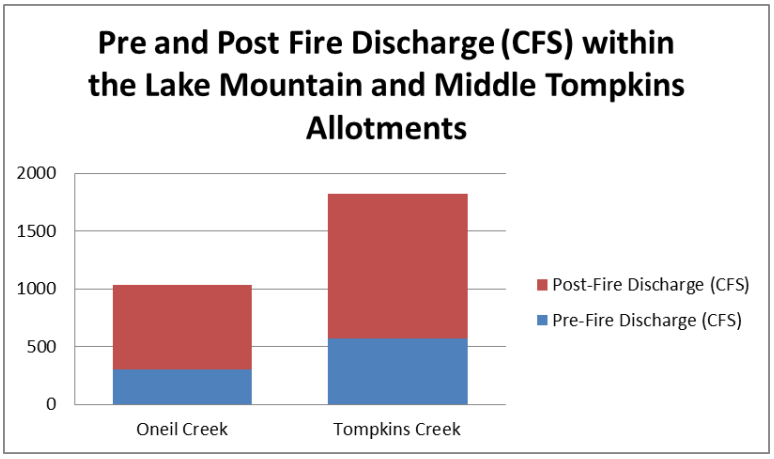
STREAM	V*	SURFACE SEDIMENT <2MM	SUBSURFACE SEDIMENT <6.38 MM	SUBSURFACE SEDIMENT <0.85MM	NO OF INDICATORS > REFERENE
Tompkins Creek	0.068	2.2	63.3	27.8	2
Reference streams 85th percentile	0.11	7.1	47	19.6	N/A

Peak and Base Flow

The USGS gaging station (11520500) on the Klamath River near Seiad Valley, CA with a drainage area of approximately 6900 mi^2 is the closest to the project area. Period of record is from October 1912 to September 1925, July 1951 to current year. A maximum discharge of 165,000ft^3/s was recorded on December 23, 1964. Annual mean discharge in cubic feet per second is 3772 with annual runoff of 2,733,000 acre-feet. Most of the allotments are within the headwaters of the watersheds where base flows remain consistent throughout the year except for extreme flood events. Most of the streams and meadows within the project are spring fed. Peak flow will change due to the Happy Camp Complex wildfire, specifically in the O'Neil and Tompkins Creek 6th field watershed. For O'Neil Creek, there will be an increase of 55% of

discharge with Tompkins Creek with an increase of 59% discharge (Table 4). The primary watershed responses of the Happy Camp Complex Fire area expected to include: 1) an initial flush of ash, 2) rill and gully erosion in drainages and on steep slopes within the burned area, and 3) flash floods with increase peak flows and sediment deposition. These responses are expected to be greatest within initial storm events (Bosfield and Kwan, 2014).

Table 4. Pre- and Post-Fire Discharge (cubic feet per second)



Nutrients

There is considerable concern that nutrient pollution by livestock on public lands degrades water quality, compromising human and ecological health. Studies have shown that wilderness areas below cattle grazing areas and areas used by pack animals are at risk for containing fecal coliform organisms (Derlet and Carlson, 2006). During the summer of 2011, two grazing allotments, Mill Creek and Shackleford, were enrolled in a water quality study by UC Davis Rangeland Watershed Laboratory Department to determine if microbial and nutrient pollution by livestock on public lands degrades water quality such that it threatens human and ecological health. They found that nutrient concentrations throughout the grazing season were at least one order of magnitude below ecological levels of concern. The results were similar to U.S. Environmental Protection Agency's estimates for background water quality conditions for the region (Roche et al., 2013).

Sample sites were selected spatially to allow analysis relative to possible pollution sources in key livestock grazing areas, campgrounds, and recreational areas (swimming holes). In the Mill Creek Allotment, nutrients were found below levels of ecological concern. Average and median fecal indicator bacteria concentrations were below regulatory standards, however, 10% of samples exceeded the REC-1 fecal coliform standard, 6% exceeded the REC-2 fecal coliform standard and 6% exceeded the EPA *E. coli* standards (Tate, 2011a). In the Shackleford Allotment, nutrients were well below levels of ecological concern, with the exception of a single sample that had elevated total phosphorous. Average and median fecal indicator bacteria concentrations were well below regulatory standards, however, 8% of samples exceeded the

REC-1 fecal coliform standard, 2% exceeded the REC-2 fecal coliform standard and 1% exceeded the EPA *E. coli* standards (Tate, 2011b).

Desired Condition

The Klamath National Forest Land and Resource Management Plan (USFS, 1995) developed future desired conditions Forest-wide and in designated management areas. The Forest Service adopted the Aquatic Conservation Strategy for the Klamath National Forest (Forest Plan 4-6 and 4-7) and designated management area standards and guidelines in the Forest Plan to help achieve future desired conditions. Forest-wide Standards and Guidelines #1-3 for best management practices (BMPs) helps meet geologic, water, soil and air quality objectives (LMRP, p. 4-18). Important RRs (MA-10, 4-133 – 4-144) Standards and Guidelines are as follows:
MA 10-2 *identifying interim widths for Riparian Reserves*

MA 10-18 to *-20 fish and wildlife habitat management*

MA 10-73-77 *Range Management*

MA 10-55 *vegetation management*

The general forest-wide theme for the desired future condition of watersheds is that "[h]igh quality water in Forest streams and rivers will continue to provide the medium for healthy riparian and aquatic habitats" (Forest Plan, page 4-14). Watersheds in poor condition due to wildfire or legacy effects from land management will begin to respond to restoration practices. Important future desired conditions for Riparian Reserves are in the KNF Forest Plan (pp. 4-133 and 4-136).
Desired conditions and management opportunities for Riparian Reserves and streams were identified in the Lower Scott Ecosystem Analysis (USFS, 2000a) and Thompson/Seiad/Grider Ecosystem Analysis (USFS, 1999).

Table 5. Project related management opportunities that would help move the Lower Scott River and the Klamath watershed towards desired condition

Desired Condition	Management Opportunity
The watersheds are resilient to natural disturbance and management activities. Within the analysis area, none of the watersheds are impaired or approaching impairment threshold.	Design and location of future management activities improve or maintain subwatershed conditions. Examples; avoid unstable lands, avoid constructing new roads, use prescribed fire and vegetation management to reduce fuel loadings.
Habitat is sufficient for sustainable Populations of indigenous aquatic species. Fine sediment input, accumulation, and transportation are reduced to reference levels.	Restore natural stream processes allowing streams to become resilient to disturbance; decrease amounts of fine sediment entering stream systems, especially from road systems in upper watersheds.

Delineation of Riparian Reserves continues through project level planning.	Further refine delineation of Riparian Reserves at the project level to a) facilitate project planning while meeting Riparian Reserve objectives, b) ensure location of Riparian Reserves in relation to project locations, c) validate both watershed level and *Forest Plan* level Riparian Reserve mapping. Priorities for project level Riparian Reserve delineation should be placed in areas where management activities are planned.
Aquatic Dependent Species management activities maintain or improve cold water contribution to Klamath. Tributaries continue to provide cold, high quality water.	Design and placement of future management activities does not contribute to water quality degradation, including water temperature. Identify and monitor crucial cold water streams.
Visitors to the wilderness will find an area "affected primarily by the forces of nature…imprint of man's work will be substantially unnoticeable…outstanding opportunities for solitude.	Inform the public of authorized, nonconforming uses, such as livestock, that they might encounter. Educate them on proper wilderness behavior and etiquette. Manage authorized nonconforming uses to mitigate or lessen their adverse effects on the wilderness character and solitude.

Environmental Consequences

Alternative 1 – No Action

Direct Effects and Indirect Effects

Under this alternative, grazing activities would cease and the risk of having new grazing-related influences on riparian areas and water quality would be eliminated. Residual effects from past grazing will remain on the landscape and passively heal with time. Localized impacts to stream channels associated with livestock grazing activities would cease. Beneficial uses will continue to be impacted from the aftermath of the Happy Camp Complex wildfire.

If grazing activities were to cease and the excess bank disturbance and instability attributable to livestock trails would stabilize and revegetate quickly because existing vegetation has excellent vigor. On a 7th- field watershed-wide basis, there would be no changes to water quality or quantity if grazing activities ceased. While grazing activities have potential to deliver sediment to water courses, effects are localized and not measurable when considered at the 7th- field watershed scale.

Under this alternative, the majority of the forested stream channels would remain in their current condition and the headcut in Faulkstein Meadow's would continue to move uphill without any additional disturbance. Over time, most disturbed areas would revegetate, thereby protecting localized stream banks from erosion and sedimentation on adjacent water courses. Revegetated stream banks would eventually result in narrower and deeper stream channels which would in turn result in locally cooler summer water flows within the meadows. In addition, livestock related-fecal matter would be eliminated.

Analysis indicators are listed below along with the likelihood of causing a negative or detrimental impact to water quality.

Sediment

Lake Mountain Allotment

- *Site Scale*- Existing livestock crossings across streams and trampling along streams banks would begin to heal. Likely to have a small beneficial impact
- *Reach Scale*-Existing livestock crossings across streams and trampling along streams banks would begin to heal. Likely to have a small beneficial impact.
- *Watershed Scale*-Sediment input by livestock crossings and trampling will not be detectable at the 7th-field watershed scale.

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Peak and base flow

Lake Mountain Allotment

- *Site Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*-No effect

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Temperature

Lake Mountain Allotment

- *Site Scale*- Riparian Reserve vegetation will grow to their potential and therefore provide more shade to the stream resulting in decreased temperatures within streams. The likelihood of detrimental impacts and consequences are low.
- *Reach Scale*- Riparian Reserve vegetation will grow to their potential and therefore provide more shade to the stream resulting in decreased temperatures within streams. The likelihood of detrimental impacts and consequences are low.
- *Watershed Scale*- Riparian Reserve vegetation will grow to their potential within meadows. The likelihood of detrimental impacts and consequences are very low.

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Riparian Vegetation Condition

Lake Mountain Allotment

- *Site Scale*- Riparian Reserve vegetation will grow to their potential. The likelihood of detrimental impacts and consequences are low.
- *Reach Scale*- Riparian Reserve vegetation will grow to their potential. The likelihood of detrimental impacts and consequences are low.
- *Watershed Scale*- Riparian Reserve vegetation will grow to their potential within meadows. The likelihood of detrimental impacts and consequences are very low.

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Channel Condition/Geomorphology

Lake Mountain Allotment

- *Site Scale*- Channel condition/geomorphology of streams within meadows will recover from past trampling and stream widening due to livestock. The likelihood of detrimental impacts and consequences are low.
- *Reach Scale*- Channel condition/geomorphology of streams within meadows will recover from past trampling and stream widening due to livestock. The likelihood of detrimental impacts and consequences are low.
- *Watershed Scale*- Channel condition/geomorphology of streams within meadows will recover from past trampling and stream widening due to livestock. The likelihood of detrimental impacts and consequences are very low.

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Nutrients

Lake Mountain Allotment

- *Site Scale*- Nutrient input due to livestock would cease. The likelihood of detrimental impacts and consequences are low.
- *Reach Scale*- Nutrient input due to livestock would cease. The likelihood of detrimental impacts and consequences are low.
- *Watershed Scale*- Nutrient input due to livestock would cease. The likelihood of detrimental impacts and consequences are very low.

Middle Tompkins Allotment

- *Sites Scale*-No effect
- *Reach Scale*- No effect
- *Watershed Scale*- No effect

Cumulative Effects

Lake Mountain

All insignificant beneficial effects are restricted to Lake Mountain Allotment because only this allotment would undergo management change to discontinue grazing. Cumulative effects would be beneficial on a site and reach scale but not detectable on a watershed scale. A future foreseeable Federal action for which there is the potential for cumulative impact is Westside Fire Recovery. Proposed actions potentially overlap with Lake Mountain and Middle Tompkins Allotment Management Project. The collective cumulative effects from both projects will be negligible and not detectable on a watershed scale due to project Best Management Practices and Project Design Features.

Middle Tompkins

Middle Tompkins Allotment has not been grazed since 2007 and therefore, does not have indirect or direct effects. Without direct or indirect effects within the footprint of future foreseeable actions, there cannot be cumulative effects.

Alternative 2 - Proposed Action

Direct and Indirect Effects

A direct effect of livestock trampling within streams is sediment input. Sediment is expected to increase at the site scale in livestock crossings over streams and in meadows; however, sedimentation associated with grazing activities is expected to be localized and not widespread. Less than 1% of Hydrologic Riparian Reserve areas correspond with High Use Levels with moderate use levels ranging from <1% to <3%, therefore, grazing activities have some influence on the sediment regime within the watersheds at small localized sites, however, the effect is negligible when considered in a watershed context.

Livestock may indirectly affect peak and base flow by changing the geomorphology of the channel and therefore affecting peak and base flow. Trimble and Mendel, (1995) found that streams which primarily receive relatively equitable flow from snowmelt are less vulnerable than streams that receive high intensity, long duration storms. Both the Lake Mountain and Middle Tompkins Allotments receive relatively equitable flow throughout the year because of the elevation of the streams and springs within the allotments. Therefore, peak and base flow within the allotments are not expected to significantly change as a result of grazing.

Livestock can increase stream temperature by removing shade (overhanging vegetation) in the Riparian Reserve. Two watersheds within the Middle Tompkins Allotment (vacant) were measured in 2011 showed existing percentage of shade in the Tompkins watershed at 90.3% and Middle Creek watershed at 90.5% (USFS, 2011). This is consistent with what was found during

the field visits to the streams adjacent to the high use and moderate use meadows. Stream temperatures were measured during the 4 PFC evaluation sites (Kuntz Creek, Townsend Meadow, Tyler Meadow, and Faulkstein Meadow) had water temperatures below the 16^0C threshold for juvenile salmonids. The elevated temperatures found in stream temperature monitoring are most likely due to the 1987 wildfire and the 1997 floods as well as the monitoring sites are well downstream of PFC sites which were evaluated near headwaters. In addition, the effects of the Happy Camp Complex wildfire will be reflected in subsequent years. Until the watershed recovers from these events, stream temperature is not likely to decrease.

Livestock can alter Riparian Reserve conditions by preferentially grazing on targeted species and thus altering Riparian Reserve vegetation. As shown in Table 2, <1% of Hydrologic Riparian Reserve areas correspond with High Use Levels and <1% to <3% in moderate use areas. Capable use levels range from 21%-23% of the allotment area and not used is from 75%-77%. Riparian Reserve conditions were evaluated at all high and moderate use sites in 2012 and 2013 within the Lake Mountain and Middle Tompkins Allotments. Most Riparian Reserves were in good condition, with most grazing concentrated in meadows. Additionally, adaptive management will mitigate potential overgrazing.

Livestock can alter channel conditions by bank trampling. The meadow will be closely monitored yearly and Adaptive Management Strategies will be implemented such as livestock exclusion or fencing if the existing conditions are negatively impacted. Marlow et al. (1987) found that detrimental effects to stream channels were directly tied to soil moisture. A combination of high flows and moist streambanks offers a greater opportunity for livestock to cause streambank alterations. Conversely, if livestock presence on the landscape is properly timed, Marlow et al. observed no differences between riparian impacts between livestock that were excluded from the riparian and livestock that were not excluded from the riparian. On KNF, livestock entry onto the allotment or into a specific pasture is not permitted until soils are dry enough to prevent damage and the key plant species are mature enough to withstand grazing. Hence, channel conditions on the Lake Mountain Allotments (actively grazed) and Middle Tompkins (rested) were similar.

Direct nutrient effects are livestock trampling and excrement along streams or within streams, meadows, or wet areas where there's a direct route into a stream, adding nutrients and fine sediment. Indirect effects are degraded water quality such as increasing fecal coliforms into the stream with the potential to exceed water quality standards. In the Lake Mountain Allotment, livestock as well as wildlife excrement were found within the Riparian Reserve and within meadows. However, water quality studies on two active allotments on the KNF in 2011 resulted in nutrients below levels of ecological concern (Tate 2011a; Tate 2011b). In addition, strategic livestock attractants including stock water, mineral supplements, and protein supplements can strongly influence livestock use away from the Riparian Reserve. KNF uses the Adaptive Management Program which necessitates that management action will be applied to meet design criteria standards when monitoring indicates that standards are not being met (See *Lake Mountain and Middle Tompkins Allotment Management Plan Environmental Assessment* for more details on Adaptive Management strategies).

Analysis indicators are listed below along with the likelihood of causing a negative or detrimental impact to water quality.

Sediment

Lake Mountain Allotment

- *Site Scale*- Existing livestock crossings across streams and trampling along streams banks would persist resulting in sediment input. Likelihood of detrimental impacts is high, consequences to those impacts medium since less than 1% of the Riparian Reserve evaluated was intersected by stream crossings at Kuntz Creek in the Lake Mountain allotment.
- *Reach Scale*- Existing livestock crossings across streams and trampling along streams banks would persist resulting in sediment input. Likelihood of detrimental consequences to those impacts is medium due to the abundance and vigor of existing riparian vegetation, minimal livestock crossings and bank trampling. Most of the sediment inputs are filtered and detained before leaving the reach.
- *Watershed Scale*- Sediment input by livestock crossings and trampling will not be detectable at the 7th-field watershed scale. Current and post risk ratio for ERAs at the 7th-field watershed scale are below Threshold of Concern (TOC) see Appendix B. Grazing activities have some influence on the sediment regime within the watersheds at small localized sites; however, the effect is very small when considered in a watershed context. Likelihood of detrimental impacts is low, consequences to those effects are also low.

Middle Tompkins Allotment

- *Sites Scale*- All past livestock crossings and bank trampling have healed, however, allowing livestock into this allotment will result in new sediment input to streams via livestock crossings and bank trampling. Likelihood of detrimental impacts and consequences are high.
- *Reach Scale*- There will be new livestock crossing and bank trampling, however, based upon what was seen at the Lake Mountain Allotment, the likelihood of detrimental impacts and consequences to those impacts is medium. Streambank trampling within the Lake Mountain Allotment was minimal within meadows at <10%. 1% of the Stream reaches adjacent or within meadows was affected by streambank crossings.
- *Watershed Scale*- Sediment input by livestock crossings and trampling will not be detectable at the 7th-field watershed scale. Current and post risk ratio for ERAs at the 7th-field watershed scale are below Threshold of Concern (TOC) see Appendix B. Likelihood of detrimental impacts is low, consequences to those effects is also low.

Peak and base flow

Lake Mountain Allotment

- *Site Scale*- Peak and base flow has greater potential to impact streams flowing through meadows than streams adjacent to meadows. Most streams are well vegetated and full of dense shrubs which function as livestock fencing except for sections without the vegetation where livestock crossings are located. Additionally, widening of certain sections of channels was observed.. Widening

of the stream channel can affect peak and base flows, however, they were minimal and not undesirable. These widened areas have the potential to become ponds which may filter out fine sediment, slow peak flows, and provide aquatic habitat. The likelihood of detrimental impacts and consequences are medium within meadows. For streams adjacent to meadows, the likelihood of detrimental impacts and consequences to those impacts are low.

- *Reach Scale*- There were some disturbances within meadows such as bank trampling, slumping, and widening, however they were minimal, healing, and had vegetation growing on the failed sections. Therefore, the likelihood of detrimental impacts as well as consequences is medium.
- *Watershed Scale*- There will be no detectable changes to peak or base flow on a watershed scale, therefore, the likelihood of detrimental impacts and consequences are low.

Middle Tompkins Allotment

- *Sites Scale*- There is potential for there to be an impact on peak and base flow but since the allotment been rested and the riparian's well vegetated with stable banks, the potential is medium for detrimental impacts and consequences.
- *Reach Scale*- There is potential for there to be an impact on peak and base flow but since the allotment been rested and riparian areas are well vegetated with stable banks, the potential is medium for detrimental impacts and consequences.
- *Watershed Scale*- There will be no detectable changes to peak or base flow on a watershed scale, therefore, the likelihood of detrimental impacts and consequences are low.

Temperature

Lake Mountain Allotment

- *Site Scale*- Livestock can increase temperature within meadows by bank trampling, widening stream channels, and grazing within the Riparian Reserve, thus allowing greater solar radiation to reach the water. On the ground observation found this to be true, however, two Proper Functioning Condition (PFC) assessment were performed on Kuntz Creek and Townsend Meadow and had water temperatures at 9°C and 10°C respectfully which is below the 16°C threshold for beneficial uses for core juvenile salmonids (USFS, 2012). Based on observations and very few Hydrologic Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts is high and consequences are medium.
- *Reach Scale*- Based on observations and very few Hydrologic Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts and consequences are medium.

- *Watershed Scale*- Based on observations and very few hydrologic Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts and consequences are low.

Middle Tompkins Allotment

- *Site Scale*- Livestock will increase temperature within meadows by bank trampling, widening stream channels, and grazing within the Riparian Reserve, thus allowing greater solar radiation to reach the water. Since the allotment has been rested which allowed the Riparian Reserve vegetation to heal, the impact from livestock will be less than Lake Mountain Allotment. Based on observations and very few Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts and consequences are medium.
- *Reach Scale*- . Based on observations and very few Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts is low and consequences are low.
- *Watershed Scale*- . Based on observations and very few Riparian Reserve areas corresponding with high and moderate use areas, the likelihood of detrimental impacts is very low and consequences are very low.

Riparian Vegetation Condition

Lake Mountain Allotment

- *Site Scale*- Riparian Reserve vegetation will continue to be impacted by livestock, however, on the ground observations has shown that the impact is greater in meadows than streams adjacent to meadows. Adaptive management will prevent the meadows from being overgrazed. The likelihood of detrimental impacts is high and consequences are medium due to adaptive management strategies. (See the *Lake Mountain and Middle Tompkins Allotment Management Plan Environmental Assessment* for adaptive management strategies and quantification of grazing).
- *Reach Scale*- Riparian Reserve vegetation will be impacted by livestock but to lesser extent than the site scale. Due to adaptive management and less than 1% of Hydrologic Riparian Reserve areas corresponding with High Use Levels, the likelihood of detrimental impacts and consequences are medium.
- *Watershed Scale*- Riparian Reserve vegetation will not be affected on a watershed scale due to the low percentage of riparian vegetation available to livestock compared to the area within the allotment. Therefore, the likelihood of detrimental impacts is low and consequences are low.

Middle Tompkins Allotment

- *Site Scale*- Riparian Reserve vegetation will be impacted by livestock, however, on the ground observations within the Lake Mountain Allotment has shown that the impact is greater in meadows than streams adjacent to meadows. Adaptive management will prevent the meadows from overgrazing. Due to adaptive

management strategies as well as the allotment has been rested for seven years, riparian vegetation have had time to heal and grow to their maximum potential, therefore the likelihood of detrimental impacts is medium with medium consequences.

- *Reach Scale*- Riparian Reserve vegetation will be impacted but at a lesser extent than the Lake Mountain Allotment due to the allotment being rested. The likelihood of detrimental impacts is medium and consequences are medium.
- *Watershed Scale*- Riparian Reserve vegetation will be impacted but at a lesser extent than the Lake Mountain Allotment due to the allotment being rested. The likelihood of detrimental impacts is low and consequences are low.

Channel Condition/Geomorphology

Lake Mountain Allotment

- *Site Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock. Most of the trampling and channel modifications were found within meadows and not at streams adjacent to meadows. Livestock within wet meadows have the potential of trampling stream banks and changing the flow dynamics of streams within meadows. Trampling stream banks was seen and approximately 10% of the stream banks were impacted. Minimal widening of certain sections of channels was seen and as discussed earlier, they are not undesirable. Channel alteration the flow dynamics of streams was not observed, however, the likelihood of detrimental impacts is high and consequences are high.
- *Reach Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock. The likelihood of detrimental impacts is medium and consequences are medium due to the low percentage of high use and moderate use areas within the allotment.
- *Watershed Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock. The likelihood of detrimental impacts is low and consequences are low due to the low percentage of high use and moderate use areas within the allotment.

Middle Tompkins Allotment

- *Site Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock, however, the impact will be less than Lake Mountain Allotment since the allotment has been rested and past effects have stabilized. The likelihood of detrimental impacts is high and consequences are medium.
- *Reach Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock, however, the impact will be less than Lake Mountain Allotment since the allotment has been rested. The likelihood of detrimental impacts is medium and consequences are low.

- *Watershed Scale*- Channel condition/geomorphology of streams within meadows will continue to recover from past disturbances. The likelihood of detrimental impacts and consequences are low.

Nutrients

Lake Mountain Allotment

- *Site Scale*- Roche et al. 2013 found livestock spent approximately 5% of their day within or near streams depositing approximately 1.5% of their fecal matter within one meter of the stream. These results are consistent with what was observed in the field. Nutrient input from livestock will occur, the likelihood of detrimental impacts and consequences are high.
- *Reach Scale*- Nutrient input due to livestock would be somewhat diluted by the reach; however it will still be detectable. The likelihood of detrimental impacts and consequences are high.
- *Watershed Scale*- Nutrient input due to livestock would continue, however, it will not be detectable in a watershed scale, therefore, the likelihood of detrimental impacts and consequences are low.

Middle Tompkins Allotment

- *Site Scale*- Nutrient input from livestock would begin on the allotment. The likelihood of detrimental impacts and consequences are high.
- *Reach Scale*- Nutrient input due to livestock would be somewhat diluted by the reach; however it will still be detectable. The likelihood of detrimental impacts and consequences are high.
- *Watershed Scale*- Nutrient input due to livestock would continue, however, it will not be detectable in a watershed scale, therefore, the likelihood of detrimental impacts and consequences are low.

Cumulative Effects

Current and post Alternative Risk Ratios were below TOC for all watersheds. All watersheds within the allotments had no significant increase in risk ratios. The only increase in risk ratios from grazing is within the Middle Creek (high use) watershed. However, an increase of 0.01 will not be measureable at the watershed level. Therefore, adverse significant cumulative impacts would not occur as a result of grazing activities. Table 3 in Appendix B summarizes the Risk Ratios before and after the addition of each Alternative.

A future foreseeable action for which there is the potential for cumulative impact is the Westside Fire Recovery 2015 Project. Proposed actions potentially overlap with Lake Mountain and Middle Tompkins Allotment Management Plan. Salvage harvest for Westside Fire Recovery is preliminary, but is generally mid- to upper-slope and avoids most Riparian Reserves, however, hazardous trees treatment and hazardous fuels treatment could occur in Riparian Reserves. The most likely consequence for interaction between the two projects is for livestock to spread out upon the landscape, taking advantage of temporary forage opportunities, with livestock returning to patterns similar to pre-fire as temporary forage opportunities decrease. There's the potential

for low use areas to receive more use and thus decreasing use in high and moderate use areas. This could improve water quality by decreasing the impacts of high and moderate use areas. There is some uncertainty of how livestock will respond to proposed treatments from the Westside Fire Recovery 2015 Project and the cumulative effect to water quality. Overall Water quality (sediment, peakflow, water temperature, Riparian Reserve vegetation, channel condition, and nutrients) is not expected to change due to the Westside Fire Recovery 2015 Project, however, water quality has already changed and continues to change due to the Happy Camp Complex Wildfire. Specifically, peakflow and sediment are expected to increase due to the wildfire.

Beneficial uses will not change because:

- Sediment regime won't significantly increase
- No significant change to peak or base flow
- Temperature is not expected to significantly increase.
- Riparian vegetation condition is not expected to have a significant change
- Channel condition is not expected to change
- Nutrients will not be detectable at the watershed scale

Details of the analysis are above.

Alternative 3 –Current Management

Direct and Indirect Effects

The effects of Alternative 3 are similar to Alternative 2 except for fewer disturbances to the Riparian Reserve, because Alternative 3 includes the same type and amount of grazing within the Lake Mountain Allotment and leaves the Middle Tompkins Allotment vacant. Allotment boundaries would remain unchanged and the exclosure and trough would not be installed at lookout spring. If present conditions at lookout springs were to continue, water quality will continue to be degraded resulting in increases in sediment, increases in solar radiation, and increases in stream temperature. The differences are described below.
Analysis indicators are listed below along with the likelihood of causing a negative or detrimental impact to water quality.

Sediment

Lake Mountain Allotment

- *Site Scale*- Same as alternative 2
- *Reach Scale*- Same as alternative 2
- *Watershed Scale*- Same as alternative 2

Middle Tompkins Allotment- Same as alternative 1 for all indicators and scales

Peak and base flow

Lake Mountain Allotment

- *Site Scale*- Peak and base flow has greater potential to impact streams within meadows than streams adjacent to meadows. Most streams are well vegetated and full of dense shrubs which function as livestock fencing except for sections without the vegetation where livestock crossings are located. This was seen on the ground and approximately 10% of streams visited had livestock trampling. Additionally, widening of certain sections of channels was observed and stream benches/terraces created by livestock. Widening the stream channel can affect peak and base flows, however, were minimal and not undesirable. These widened areas has the potential to become ponds which may filter out fine sediment, slow peak flows, and provide aquatic habitat. The potential for detrimental impacts is higher in meadows than streams adjacent to meadows, however, there was very little impact to peak and base flows found during field visits. The likelihood of detrimental impacts and consequences are medium within meadows. For streams adjacent to meadows, the likelihood of detrimental impacts and consequences to those impacts are low.
- *Reach Scale*- Same as alternative 2
- *Watershed Scale*- Same as alternative 2

Temperature

Lake Mountain Allotment

- *Site Scale*- Livestock will increase temperature within meadows by bank trampling, widening stream channels, and grazing within the Riparian Reserve, thus allowing greater solar radiation to reach the water. On the ground observation found this to be true, however, two Proper Functioning Condition (PFC) assessment were performed on Kuntz Creek and Townsend Meadow and had water temperatures at 9°C and 10°C respectfully which is below the 16°C threshold for beneficial uses for core juvenile salmonids (USFS, 2012). Based on what was observed and less than 1% of Hydrologic Riparian Reserve areas correspond with High Use Levels with moderate use levels ranging from <1% to <3%, the likelihood of detrimental impacts is high and consequences are medium.
- *Reach Scale*- Same as alternative 2
- *Watershed Scale*- Same as alternative 2

Riparian Vegetation Condition

Lake Mountain Allotment

- *Site Scale*- Riparian Reserve vegetation will continue to be impacted by livestock, however, on the ground observations has shown that the impact is greater in meadows than streams adjacent to meadows. Adaptive management will prevent the meadows from overgrazing. The likelihood of detrimental impacts is high and consequences are medium due to adaptive management strategies. (See Range report for adaptive management strategies and quantification of grazing).
- *Reach Scale*- Same as alternative 2

- *Watershed Scale*- Same as alternative 2

Channel Condition/Geomorphology

Lake Mountain Allotment

- *Site Scale*- Channel condition/geomorphology of streams within meadows will be impacted by livestock. Most of the trampling and channel modifications were found within meadows and not at streams adjacent to meadows. Livestock within wet meadows have the potential of trampling stream banks and changing the flow dynamics of streams within meadows. Trampling stream banks was seen and approximately 10% of the stream banks were impacted. Minimal widening of certain sections of channels was seen and as discussed earlier, they are not undesirable. Channel alteration the flow dynamics of streams was not observed, however, the likelihood of detrimental impacts is high and consequences are high.
- *Reach Scale*- Same as alternative 2
- *Watershed Scale*- Same as alternative 2

Nutrients

Lake Mountain Allotment

- *Site Scale*- Roche et al. 2013 found livestock spent approximately 5% of their day within or near streams depositing approximately 1.5% of their fecal matter within one meter of the stream. These results are consistent with what was observed in the field. Nutrient input from livestock will occur, the likelihood of detrimental impacts and consequences are high.
- *Reach Scale*- Same as alternative 2
- *Watershed Scale*- Same as alternative 2

Beneficial uses will not change because:

- Sediment regime won't significantly increase
- No significant change to peak or base flow
- Temperature is not expected to significantly increase.
- Riparian vegetation condition is not expected to have a significant change
- Channel condition is not expected to change
- Nutrients is not expected to change

Details of the analysis are above. They are similar to Alternative 2, although the impacts for Alternative 3 would be less overall because Middle Tompkins would be left vacant.

Cumulative Effects

Alternative 3 would continue current management practices upon the Lake Mountain Allotment and leave Middle Tompkins vacant. Because current management is similar to Alternative 2 in

respect to water quality impacts, the cumulative effects discussion presented for Lake Mountain is also valid. There would be no cumulative effects in the Middle Tomkins allotment area. In summary, there is some uncertainty of how livestock will respond to proposed treatments. Water quality (sediment, peakflow, water temperature, Riparian Reserve vegetation, channel condition, and nutrients) is not expected to change due to the Westside Fire Recovery 2015 Project, however, water quality has changed and will continue to change due to the Happy Camp Complex Wildfire. Specifically, peakflow and sediment are expected to increase due to the wildfire.

Summary of Effects

For all alternatives, the beneficial effects are the most sensitive at the site level, moderately sensitive at the reach level and not detectable at the watershed level. Less than 1% of Hydrologic Riparian Reserve areas correspond with High Use Levels with moderate use levels ranging from <1% to <3%, therefore, grazing activities have some influence on beneficial uses within the watersheds at small localized sites, however, the effect is negligible when considered in a watershed context.

Compliance with law, regulation, policy, and the Forest Plan

The project meets all the relevant conditions for the Non-point Source Sediment Discharge Waiver. This will meet the requirements for the Clean Water Act, the Total Maximum Daily Load and the Basin Plan. The Standards and Guides in the Forest Plan are met through project design and analysis (See Forest Plan checklist in project record).

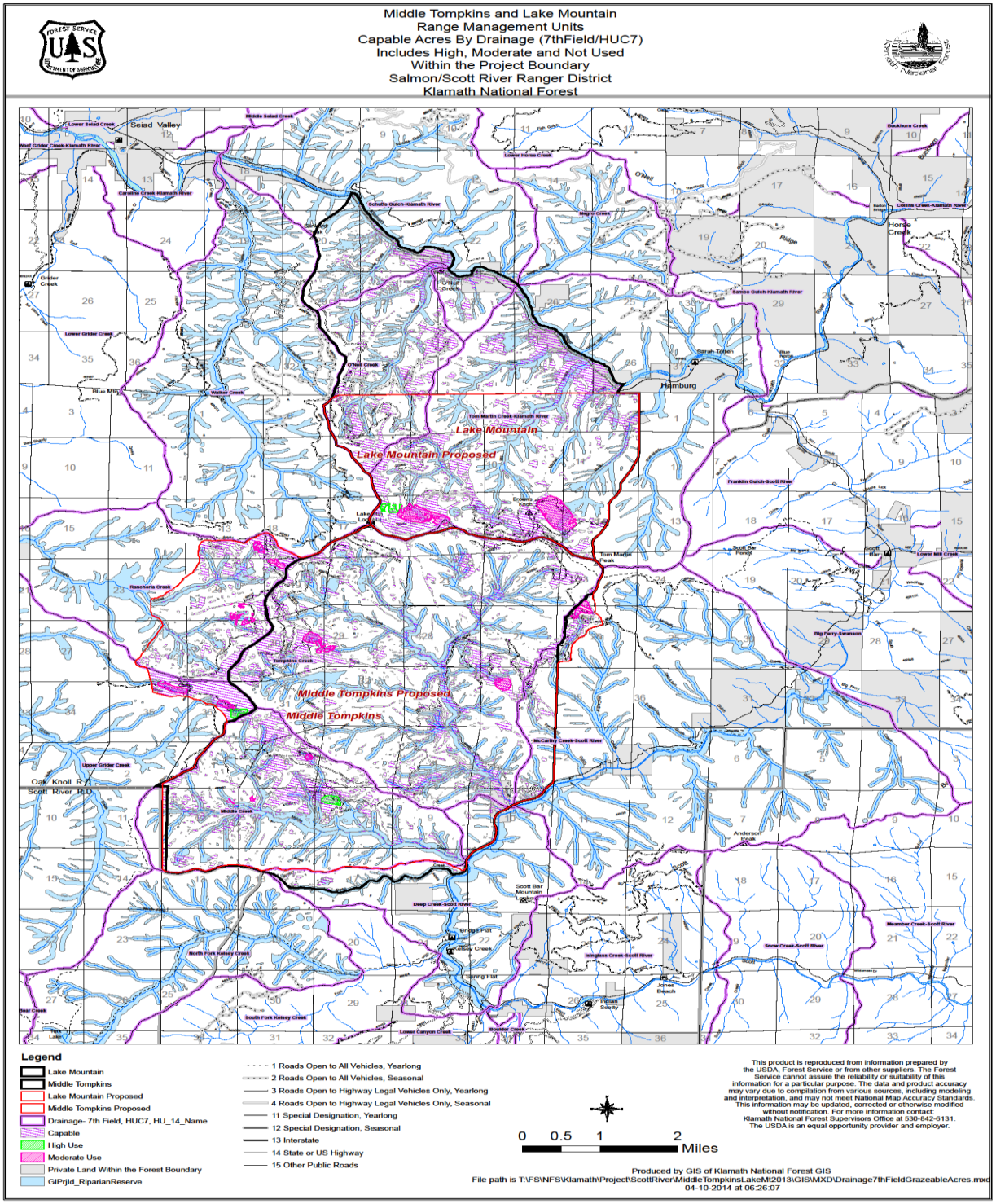


Figure 1. Lake Mountain and Middle Tompkins Capable Acres by 7th -field watershed.

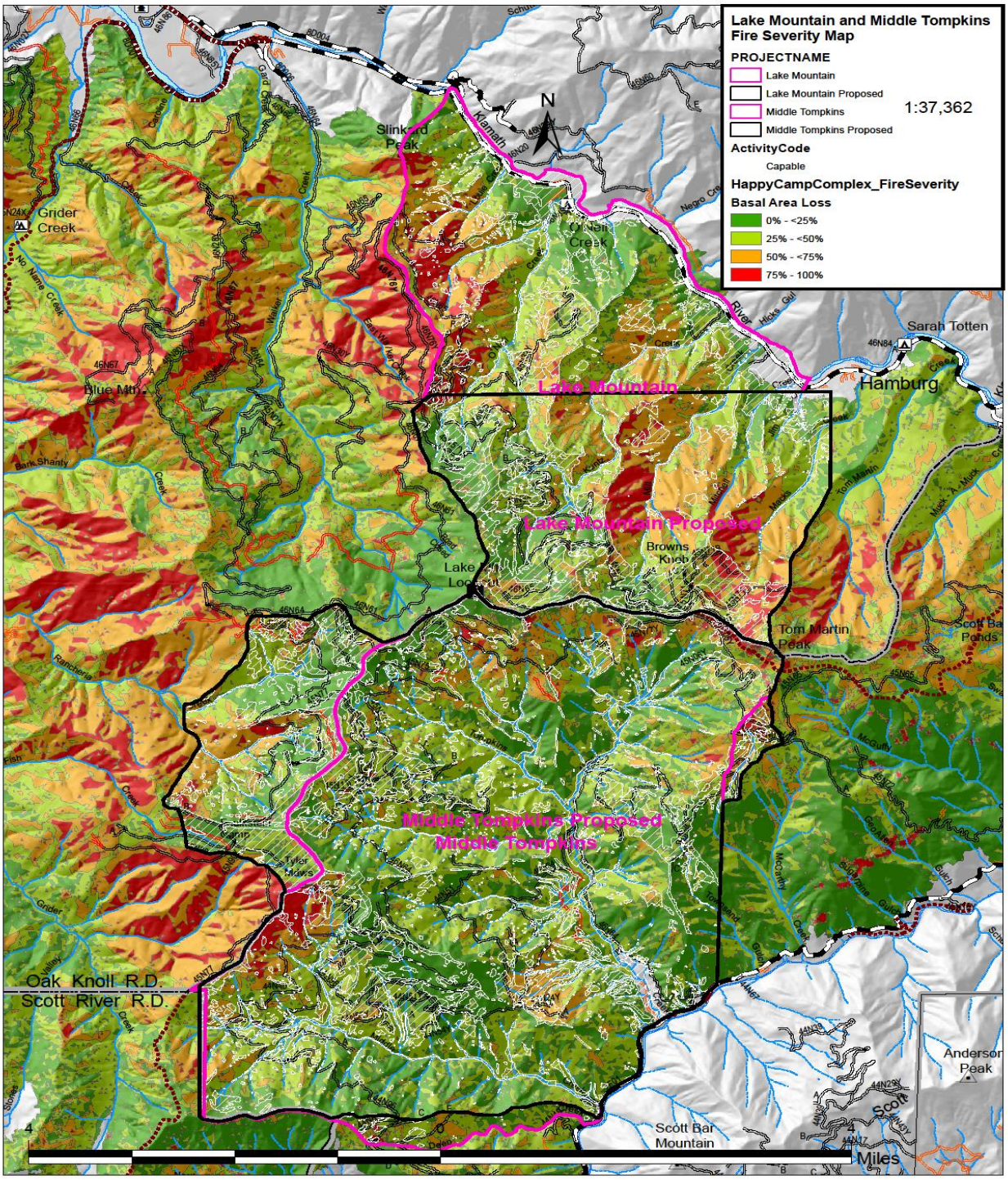


Figure 2. Lake Mountain and Middle Tompkins Fire Severity Map

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Appendix A- Consistency with Aquatic Conservation Strategy

The Klamath National Forest Plan incorporated the Aquatic Conservation Strategy (ACS) from the Northwest Forest Plan. The four components of the ACS are: 1) establishment and management of Riparian Reserves, 2) Key Watersheds, 3) Watershed Analysis, and 4) Watershed Restoration. The strategy and related standards and guidelines (S&Gs) are in the Forest Plan on pages 4-25 through 4-27, which references discussion specific to the Riparian Reserve management area on pages 4-106 through 4-114. The ACS objectives can be found in the Forest Plan on page 4-6.

The project is consistent with the four components of the ACS. Riparian Reserve boundaries were delineated using the interim widths from the Forest Plan (S&G MA 10-1 and 10-2, pages 4-107 and -108). Site potential tree height defines the extension of Riparian Reserves from stream channels. Site potential tree height in the project area is 170 feet for all types of streams and springs and 340 feet for fish bearing streams. In addition to aquatic and riparian areas, lands deemed unsuitable for sustained timber production are managed as Riparian Reserves to maintain slope stability and soil productivity and meet ACS objectives. These areas include active landslides, toe zones of rotational slumps and earthflow deposits, all inner gorges and severely dissected and weathered granitic terrain. Riparian Reserves for these unstable or potentially unstable areas are limited to the extent of the feature

Lake Mountain Allotment has no key watersheds, but Middle Tompkins Allotment has one key watershed, Upper Grider Creek, however, only 4% is within the Riparian Reserve. Watershed Analysis has been completed and is documented in *Lower Scott Ecosystem Analysis (USFS, 2000a) and Thompson/Seiad/Grider Ecosystem Analysis (USFS, 1999).*

Current monitoring protocols (Key Plots, BMPEP, Photo Points, Utilization Monitoring –See Section 2.2 in EA) have been developed to ensure compliance with LRMP Standards and Guidelines to protect and preserve the existing complexity and diversity of both the terrestrial and aquatic ecosystems in addition to complying with ACS Objectives. These current monitoring protocols will be carried forward under Alternative 2 in addition to supplemental willow monitoring.

BMPEP monitoring performed indicates that the project area is currently compliant with ACS under the existing conditions. Alternative 2 would employ additional monitoring and protection of Lookout Spring and Faulkstein headcut.

The nine **ACS objectives** are evaluated to assure that this project does not retard or prevent attainment of the objectives and, to the extent practicable, contributes toward attainment as provided by range management standards and guidelines for Riparian Reserve, MA 10-73, 10-74, 10-75, 10-76, 10-77. This standard has been met for all nine objectives as described within Table 5.

Table 6. Proposed Project (Alternative 2) and the ACS objectives.

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.	Grazing activities will not alter the distribution, diversity and complexity of watershed and landscape-scale features such that aquatic systems will be negatively impacted. Grazing activities do not influence the large-scale sediment regime within any watershed. Grazing activities do not influence landslide processes that are the dominant sediment delivery mechanism, nor will they result in widespread impacts to riparian areas such as pervasive bank trampling throughout the allotments. Terms and conditions in the Adaptive Management Strategy (AMS) have been developed to ensure compliance with LRMP Standards and Guidelines to protect and preserve the existing complexity and diversity of both the terrestrial and aquatic ecosystems. Implementation of the formal AMS based on a desired condition with project design criteria to meet that desired condition is intended to comply with this ACS objective.
2. Maintain and restore spatial and temporal connectivity within and between watersheds Lateral longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic- and riparian-dependent species.	Grazing activities will maintain the existing spatial and temporal connectivity within and between watersheds. Grazing activities will not create physical barriers between floodplains, wetlands, headwater tributaries and intact refugia. Natural barriers exist with the watersheds for anadromous fish due largely to the steepness of the headwater streams. There will be no perceivable disruptions in spatial connectivity of watersheds in the analysis area. The desired condition is a resilient ecosystem that provides sustainable forage for both livestock and wildlife, in a mosaic of vegetative patterns across the allotments. Livestock grazing in portions of the analysis area will be limited to the earliest on-site date of May 5th and the latest off-site date of October 31st. This time period has been established and will be adjusted based on several factors, including monitoring results from the previous season of grazing use (see Rangeland Specialist Report).

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	At the watershed scale, grazing activities will maintain the physical integrity of the aquatic system as expressed by stream processes and stream bank stability in all the watersheds. Extensive watershed-wide stream bank instability was not observed in any of the watersheds. Stream banks in the headwaters of these watersheds are largely impervious to bank trampling due to limited access due to steep slopes and the inherent resilience against disturbance associated with bedrock, boulder, and cobble stream bank substrates. Streams within meadows are more susceptible to impacts. Stream bank trampling within meadows were observed but were in specific sites where livestock cross the stream and where livestock access the stream to drink. Channel conditions were excellent along streams adjacent to meadows, with minimal trampling, except for livestock crossings (<1%). Channel conditions in meadows were good, minimal trampling (<10%). Livestock utilization levels will be monitoring to insure vegetation is adequate to remain vigorous, filter runoff, and cover streambanks. Best Management Practices (BMPs) and Proper Functioning Condition (PFC) assessments will note any impacts and adjustments will be made through the AMS if change is needed to maintain physical integrity of the aquatic system. The desirable condition for wet meadows is: a water table within 2 feet of the ground surface, a stream that is self-maintaining through natural processes, stream shading from vegetation, gullying is not present, and riparian vegetation is diverse and dense enough that it stabilizes the stream banks. As described in the BMP Evaluation Program in the Rangeland Specialist Report, to provide soil protection in meadow areas, monitoring of the allotment meadow areas will determine an allowable utilization level of 60% or less, with a stubble height of 3–5 inches (3–4 inches if it is in satisfactory condition; 4–5 inches if it is in unsatisfactory condition) and a residual dry matter average of 1,500 lbs. or more. Riparian areas will have a utilization level of 50% or less.

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction and migration of individuals composing aquatic and riparian communities.	On a watershed scale, grazing activities will not significantly alter existing water quality. Grazing activities will contribute some nutrient loading; however, it will not be affected on a watershed scale. Livestock are only on the landscape from July to October when the ground is least susceptible to impacts. On a watershed scale, grazing activities will not alter existing summer water temperatures or flows. The majority of riparian areas within the allotments have natural shade and portions of the headwaters have been altered by previous floods and wildfires. Grazing activities will not significantly add to the existing conditions and will not prevent healing of the watershed from past disturbances. Livestock utilization levels will be monitoed to insure vegetation is adequate to remain vigorous, filter runoff, and cover streambanks. BMP's and PFC assessments will note any impacts and adjustments will be made through the AMS if change is needed to maintain water quality. This project is consistent with Riparian Reserve guidelines, which prohibit and regulate activities in the Riparian Reserves that may prevent or retard attainment of the ACS. Water quality is expected to remain at existing conditions. Maintenance of water quality would be achieved through minimizing sediment delivery to stream courses. Monitoring of riparian areas to ensure that they are properly functioning will occur on an annual basis. Criteria for evaluation will be the implementation and effectiveness monitoring of the grazing BMP, stream bank alteration remaining within standards (20-30%), stream channel cross-section changes are noted, LRMP forage utilization guidelines are met, and Proper Functioning (PFC) assessments made.

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.	At the watershed scale, grazing activities will maintain the sediment regime under which the aquatic ecosystems evolved. Stream sediment monitoring on the KNF from 2011 found Tompkins Creek (managed stream within the Middle Tompkins Allotment) had sediment indicator meeting reference conditions. Stream bank trampling was most prevalent within meadows. Field visits to high use areas found minimal streamside trampling. Two BMP evaluations have been completed on the Lake Mountain Allotment at the Lookout Spring area; one in 2012, and a follow-up evaluation in 2013. Monitoring results in 2012 indicated that hoof prints affect more than 10% of this small spring area and may be impacting soil saturation; however the herbaceous vegetation appeared to be maintaining vigor. Implementation standards and guidelines were met. Fencing the spring area and piping water into a trough outside the exclosure was recommended. Alternative 2 includes the recommendation of fencing and the installation of a trough which will benefit water quality, decrease trampling, decrease sediment mobilization, and increase pool stability. Livestock utilization levels will be monitored to insure vegetation is adequate to remain vigorous, filter runoff, and cover streambanks. BMP's and PFC assessments will note any impacts and adjustments will be made through the AMS if change is needed to maintain the sediment regime. Monitoring of the rangeland shows satisfactory conditions of the sediment regime. The evaluation criteria for this element include implementation and monitoring of grazing BMPs, determination of forage utilization levels to meet LRMP Standards, and percent of stream bank alteration.
6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	Grazing activities as outlined in Alternatives 2 will not influence current in-stream flows. The percentage high use (<1%) and moderate use (<1% to <3%) within the allotments is very small. Widespread soil compaction has not been found within the capable lands making it highly unlikely that the winter peak or high flows within the watershed have been affected by grazing activities. The Proposed Action offers no management activities that would directly divert or reduce stream flows within the allotment areas. There would be no change in seasonal fluctuations of stream flow outside the range of natural variability. The evaluation for this objective include: assuring that forage utilization standards are met, noting stream channel cross section data, and performing PFC or MIM if needed.

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	Grazing activities will maintain the timing, variability and duration of floodplain inundation. No impoundments of water in main stem or key perennial stream reaches are proposed or exist currently. Grazing activities will maintain the water table in meadows and wetlands. Soil compaction was minimal within meadows. Grazing activities do not appear to be influencing the water table within the meadows due the moderate and high condition of the meadows. Meadows in the analysis area are very small, localized areas associated with springs. Grazing activities are not likely to influence to the hydrology of these springs. This project proposes the continuation of grazing in allotments found already acceptable by continuous evaluation. Any effects to the water table would be negligible, because the allotment would remain vigorous and efficient as an evapotranspiration mechanism. The evaluation for this objective include: assuring that forage utilization standards are met, noting stream channel cross section data, and performing PFC or MIM as needed.
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	Species composition and structural diversity within riparian areas in the affected allotments reflects a late seral riparian community in most areas of the watershed. Under current grazing practices, long-term rangeland monitoring shows that key areas are meeting or moving toward desired conditions in both allotments. Riparian woody species will be monitored for utilization and condition class to ensure desired conditions are being met. Ecological condition and utilization will continue to be monitored and if design criteria are not being met, the AMS will be implemented until areas are meeting or moving toward desired conditions. Species composition of plant communities in riparian areas would be maintained or restored through limiting the degree of grazing in riparian areas. Structural diversity would be maintained or restored by leaving snags in areas connected to the aquatic system. The evaluation for this objective include: assuring that forage utilization standards are met, noting stream channel cross section data, and performing PFC or MIM as needed.

Aquatic Conservation Strategy Objectives	How Proposed Action meet and not prevent attainment of the ACS objectives
9. Maintain and restore well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Grazing activities will not impact the pre-existing populations of native plant, invertebrate and vertebrate riparian species. Livestock entry onto the allotments or a specific pasture is not permitted until soils are dry enough to prevent damage and key plant species are ready to withstand grazing. Long-term rangeland monitoring shows that key areas are meeting or moving toward desired conditions in both allotments. This trend is expected to continue under this alternative because the alternative includes adaptive management actions that can be implemented if design criteria are not being met. Reducing the risk of overgrazing would increase the likelihood of a well-distributed mix of habitats. A well distributed mix of riparian habitats would maintain the riparian-dependent species. Evaluation criteria includes: utilization levels meeting LRMP standards, vegetative condition and trend in riparian vegetation related to grazing, BMP effectiveness and implementation monitoring, and stream bank disturbance monitoring as needed.

Appendix B- CWE Analysis

Introduction

To assess potential for grazing activities within the two allotments to result in additional cumulative effects, acres of grazed grasslands and grazed riparian areas were assessed, in addition to the extent of road miles and acres of timber harvest within all affected watersheds. These impacts were assessed using the Region 5 Equivalent Roaded Acres (ERA) Model which is designed to be an initial red flag for earth scientists to determine whether or not past and present land management activities in a given watershed approach or exceed a threshold of concern (TOC). Where ERAs approach or exceed a given watershed's TOC, further field work would be necessary to ascertain whether cumulative watershed effects are present and if land management activities would adversely add to those effects and result in detrimental impacts to beneficial uses.

The ERA methodology has both strengths and weaknesses. Strength of the ERA methodology is the ease with which the analysis can be duplicated and understood. It is also a CWE model that incorporates rates of land management disturbance and recovery times associated with those disturbances, an attribute which is missing in many other CWE analysis models. A weakness of the ERA CWE model is that it is an office exercise, based primarily on management-related hillslope disturbance. It does not directly assess physical or biological processes in stream channels, nor does it account for the time lag associated with routing sediment delivered from a given activity. Recovery times in the ERA model apply only to the site of a given treatment, not to the recovery of downstream impacts. When applying ERAs to grazing activities, many assumptions must be made that are perhaps overly simplistic. Livestock grazing is not a static activity as are timber sales, and livestock move freely: assumptions regarding livestock grazing within riparian areas or on grasslands are a "best guess" based upon professional judgment.

An equivalent roaded area (ERA) modeling exercise was completed for the Lake Mountain and Middle Tompkins Allotments to determine cumulative watershed effects (CWE) in accordance with Region 5 guidance (USDA, 1988). GIS feature classes of roads, fuels reduction projects, wildfire burn severity, fire suppression dozer lines and the Lake Mountain and Middle Tompkins Allotments Alternatives were combined to calculate cumulative ERAs within 7th-field watersheds (Table 1). Middle Tompkins Allotment has been rested for 7 years, the numbers shown are for the previous allotment boundary along with the proposed allotment changes. Allotment numbers include capable, high use, and moderate use. It does not include areas within the watershed designated as "not used".

Table 7 - The 6th-field watersheds (Watershed Boundary Dataset HUC14) which contain the allotment. Numbers in parentheses is the percentage of allotment vs. drainage area.

HUC 14	7th-Field Watershed	Drainage Area (Acres)	Lake Mountain Allotment (Acres)	Lake Mountain Proposed Allotment (Acres)	Middle Tompkins Allotment (Acres)	Middle Tompkins Proposed Allotment (Acres)
18010206110301	Tom Martin Creek-Klamath River	10690	1881 (18)	1434 (13)	6 (<1)	6 (<1)
18010206110304	Schutts Gulch-Klamath River	6692	273 (4)	0	0	0
18010208060501	Deep Creek-Scott River	3798	0	0	76 (2)	31 (<1)
18010206110303	O'Neil Creek	2429	604 (25)	237 (8)	0	0
18010208060403	Tompkins Creek	9327	20 (<1)	20 (<1)	1814 (19)	1824 (20)
18010208060401	Middle Creek	8047	0	0	965 (12)	972 (12)
18010206110101	Upper Grider Creek	8467	0	0	8 (<1)	352 (4)
18010206110103	Rancheria Creek	2459	0	0	3 (<1)	597 (24)
18010208060601	McCarthy Creek-Scott River	11611	0	0	116 (<1)	217 (<2)

Methods and Assumptions

The ERA modeling process provides a simplified accounting system for tracking disturbances that affect watershed processes, in particular, estimates in changes in peak runoff flows influenced by vegetative disturbances. The model compares the existing level of disturbance within a given watershed (expressed as %ERA) with the theoretical maximum disturbance level acceptable or threshold of concern (TOC). ERA is not intended to be a process-based sediment model. It does, however, provide an indicator of watershed conditions.
ERA attempts to scale vegetative disturbances as equivalent roaded areas or ERA's. The assumption is that vegetative disturbances have the same effect as roads on watersheds processes, but to a lesser degree. Coefficients are developed to weight the effects of different vegetation disturbances using professional judgment (Table 2).

Table 8 - ERA coefficients used for this modeling exercise.

Disturbance Type	ERA Coefficient
High Severity Wildfire	0.21
Moderate Severity Wildfire	0.11
Low Severity Wildfire	0.06
Fire Suppression Dozer Lines	0.33
Prescribed Fire	0.06
Mastication	0.03
Thinning	0.06
High Impact Grazing	0.06
Moderate Impact Grazing	0.03
Capable Grazing	0.02

High impact grazing areas were determined by creating ¼ acre buffers around each coral and trough. Moderate impact grazing was assumed to be in areas delineated as primary suitable forage. Capable grazing was assumed to occur throughout the capable areas of the allotment. Table A within the *Lk Mt Middle Tompkins CWE_10312014.xlsx* compares the impact acres for each alternative.

Recovery of ERA coefficients is a straight-line decay of one-tenth of the initial ERA coefficient per year. For example, a 4 year old high intensity wildfire (ERA of 0.21) will have a recovered ERA value of 0.13 (0.21-[0.021*4]). Reoccurring or persistent disturbances such as livestock grazing and roads do not have recovering ERA values.

In Summary: (1) the acreage of each disturbance is multiplied by their assigned ERA coefficient to determine ERAs at the time of disturbance; (2) recovery is applied to determine the current year ERAs; (3) the current year ERAs are added to the acres of roads to get the total ERAs in each watershed; (4) the total ERAs by watershed are divided by the drainage area to arrive at a %ERA value; (5) the %ERA value is divided into the TOC to determine the Risk Ratio (at a Risk Ratio of 1.00 the watershed has reached the TOC).

TOC is a measure of watershed sensitivity. TOC values used in this exercise are between 9-12.5% for all watersheds. This value is from *WestsideFireRecovery_CWEsummary10162014.xlsx*. The 7th field watersheds threshold of concern for ERAs was calculated as described in the 2004 CWE modeling process paper. 2014 wildfires were added to the existing condition for each watershed.

A percent ERA value approaching or greater than the TOC serves as a "yellow flag" indicator of increasing susceptibility for significant adverse cumulative effects occurring within a watershed. Susceptibility of cumulative watershed effects generally increases from low to high as the level of land disturbing activities (indicated as %ERA) increases towards or past the TOC value (USFS, 1988).

Results

Current and post Alternative Risk Ratios were below TOC for all watersheds. All 7th field watershed risk ratios became elevated due to the Happy Camp Complex wildfire. Elevated risk ratios, Tom Martin Creek-Klamath River (moderate use), Tompkins Creek (moderate use), and Middle Creek (high use) were all <1 and will not be detectable at the watershed scale. Table 3 summarizes the Risk Ratios before and after the addition of each Alternative.

Table 9. Watershed Risk Ratios before and after the addition of each Alternative (increases in risk ratio are shown in bold.

HUC14 Name	Pre Fire Risk Ratio	Post Fire Risk Ratio	Risk Ratio w/Alt 1	Risk Ratio w/Alt 2	Risk Ratio w/Alt 3
Tom Martin Creek-Klamath River (high use)	0.14	0.53	0.53	0.53	0.53
Tom Martin Creek-Klamath River (moderate use)	0.14	0.53	0.53	**0.54**	**0.54**
Tompkins Creek (moderate use)	0.35	0.54	0.54	**0.55**	**0.55**
Middle Creek (high use)	0.33	0.69	0.69	**0.70**	NA
Middle Creek (moderate use)	0.33	0.69	0.69	0.69	NA
Upper Grider Creek (high use)	0.04	0.41	0.41	0.41	NA
Upper Grider Creek (moderate use)	0.04	0.41	0.41	0.41	NA
McCarthy Creek-Scott River (moderate use)	0.39	0.50	0.50	0.50	NA
Rancheria Gulch (moderate use)	0.60	0.88	0.88	0.88	NA

Each Alternative had a very small influence on Risk Ratios due to the following: (1) the allotments relatively small area when compared to a watersheds drainage area (<1 to 25 percent) as illustrated in Table 1; (2) areas of high and moderate grazing impacts do not account for the

entire allotment and; (3) the ERA coefficients for grazing impacts (0.06 or 0.03) further reduced the area considered to be equivalent to roads.

Literature Cited

USDA Forest Service (USFS), 1988, *R-5 FSH 2509.22 – Soil and water Conservation Handbook*: USDA Forest Service, Pacific Southwest Region, San Francisco, CA., section 23.62

USFS 2011. Happy Canyon Range Allotment Cumulative Watershed Effects Model Output Report. Modeling and Report by Gregg Bousfield. ACT2 Enterprise Team.

Appendix C- Beneficial Uses

The Basin Plan lists for the beneficial uses for the Scott Bar Hydrologic Subarea and the Seiad Valley Hydrologic Subarea for the Middle Klamath River Hydrologic Area for "**Existing**" or "**Potential**" beneficial uses.

- **Municipal and Domestic Supply (MUN)** Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
  - **Existing**-Seiad Valley and Scott River
- **Agricultural Supply (AGR)** Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
  - **Existing**- Seiad Valley and Scott River
- **Industrial Service Supply (IND)** Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.
  - **Existing**- Seiad Valley and Scott River
- **Industrial Process Supply (PRO)** Uses of water for industrial activities that depend primarily on water quality.
  - **Existing**- Seiad Valley
  - **Potential**-Scott River
- **Groundwater Recharge (GWR)** Use of water for industrial activities that depend primarily on water quality.
  - **Existing**- Seiad Valley and Scott River
- **Freshwater Replenishment (FRSH)** Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).
  - **Existing**- Seiad Valley and Scott River
- **Navigation (NAV)** Uses of water for shipping, travel, or other transportation by private, military or commercial vessels.
  - **Existing**- Seiad Valley and Scott River
- **Hydropower Generation (POW)** Use of water for hydropower generation.
  - **Existing**-Scott River
  - **Potential**-Seiad Valley
- **Water Contact Recreation (REC-1)** Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white-water activities, fishing, or use of natural hot springs.
  - **Existing**- Seiad Valley and Scott River

- **Non-Contact Water Recreation (REC-2)** Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
    - **Existing**- Seiad Valley and Scott River
- **Commercial and Sport Fishing (COMM)** Uses of water for commercial, recreational (sport) collection of fish, shellfish, or other aquatic organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
    - **Existing**- Seiad Valley and Scott River
- **Warm Freshwater Habitat (WARM)** Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
    - **Existing**- Seiad Valley
- **Cold Freshwater Habitat (COLD)** Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
    - **Existing**- Seiad Valley and Scott River
- **Wildlife Habitat (WILD)** Uses of water that support terrestrial ecosystems including, but not limited to preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
    - **Existing**- Seiad Valley and Scott River
- **Rare, Threatened, or Endangered Species (RARE)** Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
    - **Existing**- Seiad Valley and Scott River
- **Migration of Aquatic Organisms (MIGR)** Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
    - **Existing**- Seiad Valley and Scott River
- **Spawning, Reproduction, and/or Early Development (SPWN)** Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
    - **Existing**- Seiad Valley and Scott River

- **Aquaculture (AQUA)** Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
    - **Potential**- Seiad Valley and Scott River
- **Native American Culture (CUL)** Uses of water that support the cultural and/or traditional rights of indigenous people such as subsistence fishing and shellfish gathering, basket weaving and jewelry material collection, navigation to traditional ceremonial locations, and ceremonial uses.
    - **Existing**- Seiad Valley